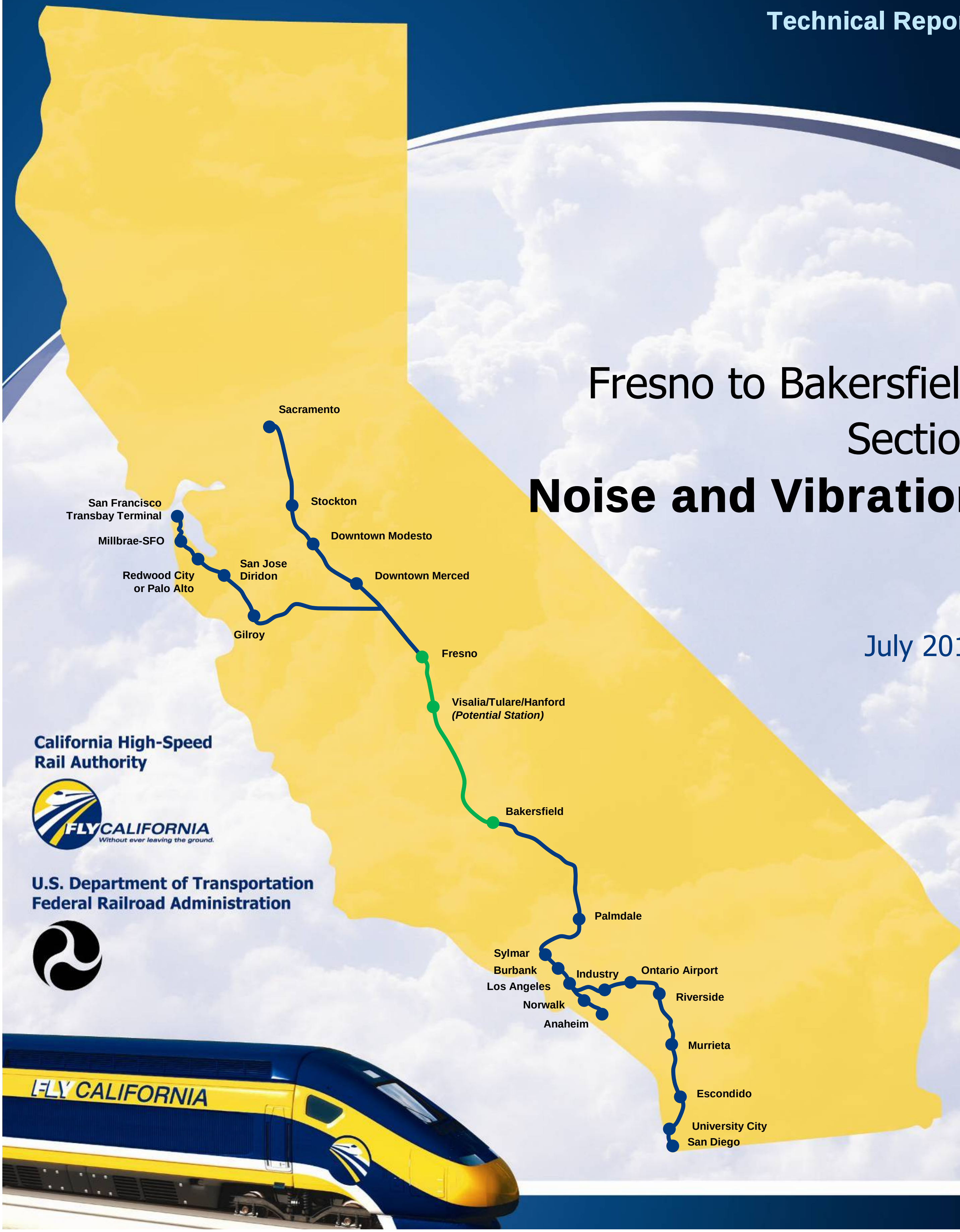
CALIFORNIA HIGH-SPEED TRAIN

Technical Report



Fresno to Bakersfield
Section

Noise and Vibration

July 2011

California High-Speed Rail Authority

FLY CALIFORNIA
Without ever leaving the ground.

U.S. Department of Transportation
Federal Railroad Administration

Noise and Vibration Technical Report

Prepared by:

URS/HMM/Arup Joint Venture

July 2011

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Acronyms and Abbreviations

Authority	California High-Speed Rail Authority
BNSF	BNSF Railway
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act of 1970
CFR.	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
dB	decibel(s)
dBA	A-weighted decibel(s)
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMF	Heavy Maintenance Facility
HST	High-Speed Train
HUD	U.S. Department of Housing and Urban Development
Hz	hertz
L_{dn}	day-night sound level, dBA
L_{eq}	equivalent sound level, dBA
L_{max}	maximum sound level, dBA
LT	Long-term measurement
mph	mile(s) per hour
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act of 1969
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
PPV	peak particle velocity
RCNM	Road Construction Noise Model

RMS	root mean square
ROD	Record of Decision
SEL	sound exposure level
SJVR	San Joaquin Valley Railroad
ST	Short-term measurement
TGV	Trains à Grande Vitesse – European High Speed Train
UP	Union Pacific
U.S.C.	United States Code
VdB	RMS vibration velocity level, decibels

Chapter 1.0
Introduction

1.0 Introduction

This technical report describes the regulatory setting, existing conditions, potential impacts, and recommended mitigation measures associated with noise and vibration generated from the proposed California High-Speed Train (HST) Project for the section between Fresno and Bakersfield, California.

The HST project is planned to provide intercity high-speed train service on over 800 miles of track throughout California that will connect the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The HST system is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology that will include state-of-the-art safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade-separated, dedicated track alignment, with an expected express-trip time between Los Angeles and San Francisco of approximately 2 hours and 40 minutes.

In 2005, the California High-Speed Rail Authority (Authority) and the Federal Railroad Administration (FRA) completed a *Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California HST System* (Statewide Program EIR/EIS) (Authority and FRA 2005), as the first-phase of a tiered environmental review process. The Authority certified the final Statewide Program EIR/EIS under the California Environmental Quality Act of 1970 (CEQA) and selected the proposed HST system alternative for further project environmental review over the No Project and Modal Alternatives, and made several corridor decisions. The Authority also issued a Notice of Determination and CEQA Findings of Fact (November 2005), and adopted a Mitigation Monitoring and Reporting Plan. The FRA issued a Record of Decision (ROD) (November 18, 2005) under the National Environmental Policy Act of 1969 (NEPA) on the Final Program EIS.

The Authority and FRA are now undertaking second-tier, project environmental evaluations for several sections of the statewide system. The project EIR/EIS documents for sections of the California HST system will be prepared to satisfy the environmental review requirements of state and federal laws and will enable the public and agencies to participate in the review of site-specific alternatives. The EIR/EIS will also help define appropriate project mitigation measures to minimize and mitigate adverse impacts that tier from the CEQA Findings of Fact (November 2005) and the ROD (November 18, 2005) for the statewide EIR/EIS. The information in the project environmental documents will be used to make decisions about the location of alignments, stations, and facilities to serve the HST and to seek permits and other needed approvals. In all cases, the project environmental analysis will reference and use the information contained in one or both of the Program EIRs/EISs to ensure consistency with previous decisions and guidance provided by the Authority and FRA. In particular, relevant mitigation strategies for impacts identified in the program- CEQA Findings of Fact and the ROD will be addressed in each Project EIR/EIS.

The Authority is both the project sponsor and the lead agency under CEQA. The Authority has determined that project EIRs for sections of the statewide HST system are the appropriate documents for this next stage of planning and decision making, which will involve further refining and evaluating alignment alternatives, station location options, maintenance facility locations, and phasing options. Coordination and consultation with local and regional agencies needed for project approvals will be part of the project environmental review process.

FRA is the federal lead agency for the preparation of the EIS. Other federal agencies with major actions or permits may choose to serve as cooperating agencies. The second-tier project EISs under NEPA for sections of the HST system are the appropriate NEPA documents for the nature and scope of the HST project, anticipated approvals and decisions by federal agencies, and the need to further examine alignment alternatives and station location options selected at the program level.

The statewide high-speed train system has been divided into several sections for purposes of developing the second-tier EIR/EISs. This Noise and Vibration Technical Report is for the Fresno to Bakersfield Section. Information from this report will be summarized in the project EIR/EIS and will be part of the administrative record supporting the environmental review of the proposed project.

Chapter 2.0
Project Description

2.0 Project Description

2.1 Project Introduction

The Fresno to Bakersfield Section of the HST project would be approximately 114 miles long, varying in length by only a few miles based on the route alternatives selected. To comply with the Authority's guidance to use existing transportation corridors when feasible, the Fresno to Bakersfield HST Section would be primarily located adjacent to the existing BNSF Railway right-of-way. Alternative alignments are being considered where engineering constraints require deviation from the existing railroad corridor, and to avoid environmental impacts.

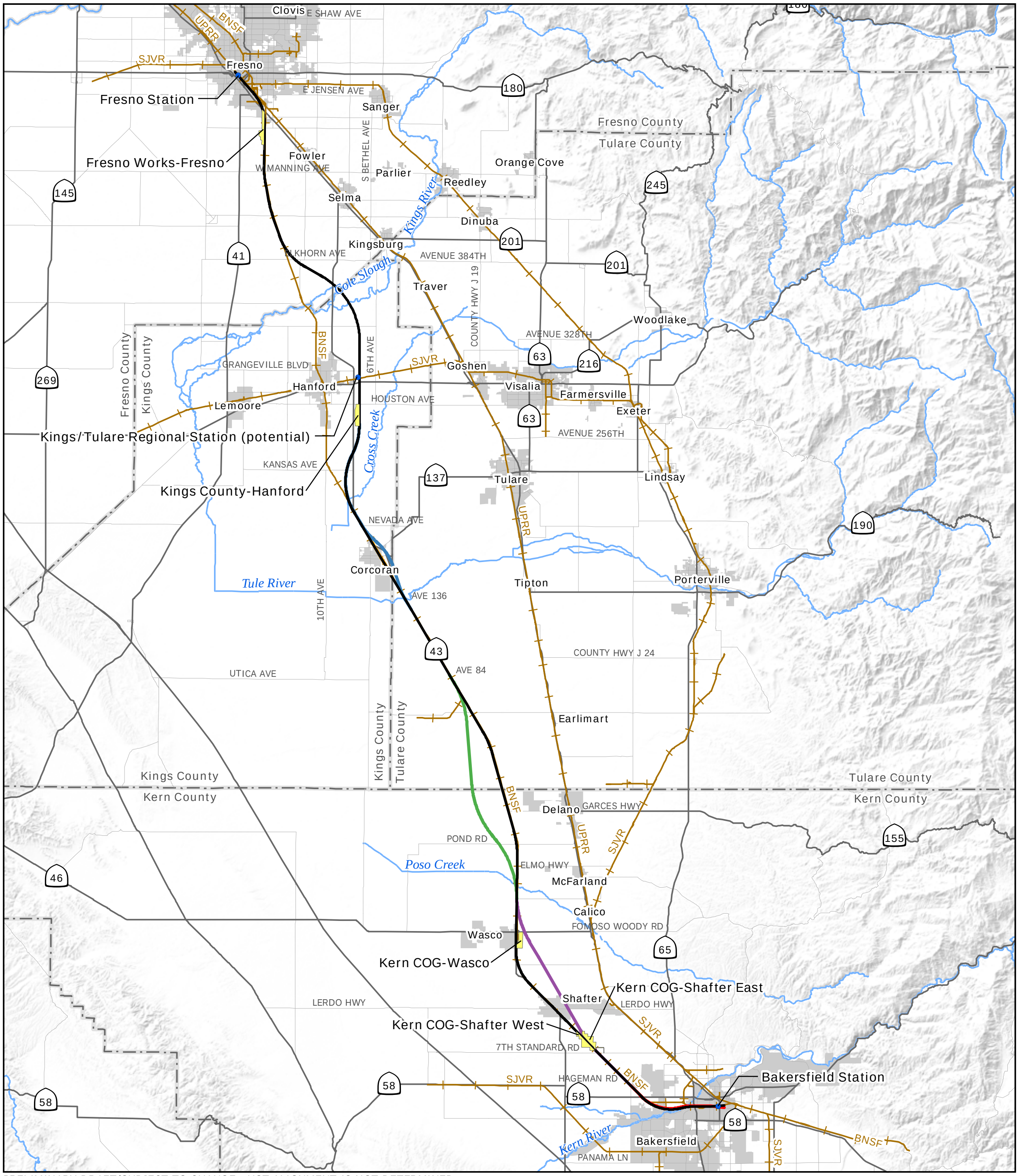
The Fresno to Bakersfield HST Section would cross both urban and rural lands and include a station in both Fresno and Bakersfield, a potential Kings/Tulare Regional Station in the vicinity of Hanford, a potential heavy maintenance facility (HMF), and power substations along the alignment. The HST alignment would be entirely grade-separated, meaning that crossings with roads, railroads, and other transport facilities would be located at different heights (overpasses or underpasses) so that the HST would not interrupt nor interface with other modes of transport. The HST right-of-way would also be fenced to prohibit public or automobile access. The project footprint would consist primarily of the train right-of-way, which would include both a northbound and southbound track in an area typically 100 feet wide. Additional right-of-way would be required to accommodate stations, multiple track at stations, maintenance facilities, and power substations.

The Fresno to Bakersfield Section would include at-grade, below-grade, and elevated track segments. The at-grade track would be laid on an earthen rail bed topped with rock ballast approximately 6 feet off of the ground; fill and ballast for the rail bed would be obtained from permitted borrow sites and quarries. Below-grade track would be laid in an open or covered trench at a depth which would allow roadway and other grade-level uses above the track. Elevated track segments would span long sections of urban development or aerial roadway structures and consist of steel truss aerial structures with cast in place reinforced-concrete columns supporting the box girders and platforms. The height of elevated track sections would depend on the height of existing structures below, and would range from 40 to 80 feet. Columns would be spaced 60 feet to 120 feet apart.

2.2 Project Alternatives

2.2.1 Alignment Alternatives

This section describes the Fresno to Bakersfield HST Section project alternatives, including the No Project Alternative. The project EIR/EIS for the Fresno to Bakersfield HST Section examines alternative alignments, stations, and HMF sites within the general BNSF Railway corridor. Discussion of the HST project alternatives begins with a single continuous alignment (the BNSF Alternative) from Fresno to Bakersfield. This alternative most closely aligns with the preferred alignment identified in the Record of Decision (ROD) for the Statewide Program EIR/EIS. Descriptions of the additional five alternative alignments that deviate from the BNSF Alternative for portions of the route then follow. The alternative alignments that deviate from the BNSF Alternative were selected to avoid environmental, land use, or community issues identified for portions of the BNSF Alternative (Figure 2-1).



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

Source: URS, 2011

BNSF Alternative
Corcoran Elevated
Corcoran Bypass
Allensworth Bypass
Wasco-Shafter Bypass
Bakersfield South
Station location
Alternative heavy maintenance facility (HMF)
Stream
Existing rail line
Community/Urban area
County boundary

N

0 5 10
Miles

0 10 20
Kilometers

Figure 2-1
Fresno to Bakersfield HST alignments

A. NO PROJECT ALTERNATIVE

Under the No Project Alternative, the HST System would not be built. The No Project Alternative represents the condition of the Fresno to Bakersfield Section as it existed in 2009 (when the Notice of Preparation was issued), and as it would exist without the HST project at the planning horizon (2035). To assess future conditions, it was assumed that all currently known programmed and funded improvements to the intercity transportation system (highway, rail, and transit), and reasonably foreseeable local development projects (with funding sources identified), would be developed by 2035. The No Project Alternative is based on a review of Regional Transportation Plans (RTPs) for all modes of travel, the State of California Office of Planning and Research CEQAnet Database, the Federal Aviation Administration Air Carrier Activity Information System and Airport Improvement Plan grant data, the State Transportation Improvement Program, airport master plans and interviews with airport officials, intercity passenger rail plans, and city and county general plans and interviews with planning officials.

B. BNSF ALTERNATIVE ALIGNMENT

The BNSF Alternative Alignment would extend approximately 114 miles from Fresno to Bakersfield and would lie adjacent to the BNSF Railway route to the extent feasible (Figure 2-1). Minor deviations from the BNSF Railway corridor would be necessary to accommodate engineering constraints, namely wider curves necessary to accommodate the HST (as compared with the existing lower-speed freight line track alignment). The largest of these deviations occurs between approximately Elk Avenue in Fresno County and Nevada Avenue in Kings County. This segment of the BNSF Alternative would depart from BNSF Railway corridor and instead curve to the east on the northern side of the Kings River and away from Hanford, and would rejoin the BNSF Railway corridor north of Corcoran.

Although the majority of the alignment would be at-grade, the BNSF Alternative would include aerial structures in all of the four counties through which it travels. In Fresno County, an aerial structure would carry the alignment over Golden State Boulevard and SR 99 and a second would cross over the BNSF Railway tracks in the vicinity of East Conejo Avenue. The alignment would be at-grade with bridges where it crosses Cole Slough and the Kings River into Kings County.

In Kings County, the BNSF Alternative would be elevated east of Hanford where the alignment would pass over the San Joaquin Valley Railroad and SR 198. The alignment would also be elevated over Cross Creek, and again at the southern end of the city of Corcoran to avoid a BNSF Railway spur. In Tulare County, the BNSF Alternative would be elevated at the crossing of the Tule River and at the crossing of the Alpaugh railroad spur that runs west from the BNSF Railway mainline. In Kern County, the BNSF Alternative would be elevated over Poso Creek and through the cities of Wasco, Shafter, and Bakersfield. The BNSF Alternative would be at-grade through the rural areas between these cities.

The BNSF Alternative Alignment would provide wildlife crossing opportunities by means of a variety of engineered structures. Dedicated wildlife crossing structures would be provided from approximately Cross Creek (Kings County) south to Poso Creek (Kern County) in at-grade portions of the railroad embankment at approximately 0.3-mile intervals. In addition to those structures, wildlife crossing opportunities would be available at elevated portions of the alignment, bridges over riparian corridors, road overcrossings and undercrossings, and drainage facilities (i.e., large diameter [60 to 120 inches] culverts and paired 30-inch culverts). Where bridges, aerial structures, and road crossings coincide with proposed dedicated wildlife crossing structures, such features would serve the function of, and supersede the need for, dedicated wildlife crossing structures.

The preliminary wildlife crossing structure design consists of a modified culvert in the embankment that would support the HST tracks. The typical culvert would be 72 feet long from end to end (crossing structure distance), would span a width of approximately 8 feet (crossing structure width), and would provide 4 feet of vertical clearance (crossing structure height). Additional wildlife crossing structure designs could include circular or elliptical pipe culverts, and larger (longer) culverts with crossing structure distances of up to 100 feet. The design of the wildlife crossing structures may change depending on site-specific conditions and engineering considerations.

C. CORCORAN ELEVATED ALTERNATIVE ALIGNMENT

The Corcoran Elevated Alternative Alignment would be the same as the corresponding section of the BNSF Alternative Alignment from approximately Idaho Avenue south of Hanford to Avenue 136, except that it would pass through the city of Corcoran on the eastern side of the BNSF Railway right-of-way on an aerial structure. The aerial structure begins at Niles Avenue and returns to grade at 4th Avenue. Dedicated wildlife crossing structures would be provided from approximately Cross Creek south to Avenue 136 in at-grade portions of the railroad embankment at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of both the Cross Creek and Tule River crossings.

This alternative alignment would cross SR 43 and pass over several local roads on an aerial structure. Santa Fe Avenue would be closed at the HST right-of-way.

D. CORCORAN BYPASS ALTERNATIVE ALIGNMENT

The Corcoran Bypass Alternative Alignment would run parallel to the BNSF Alternative Alignment from approximately Idaho Avenue south of Hanford, to approximately Nevada Avenue north of Corcoran. The Corcoran Bypass Alternative would then diverge from the BNSF Alternative and swing east of Corcoran, rejoining the BNSF Railway route at Avenue 136. The total length of the Corcoran Bypass would be approximately 21 miles.

Similar to the corresponding section of the BNSF Alternative, most of the Corcoran Bypass Alternative would be at-grade. However, one elevated structure would carry the HST over Cross Creek, and another would travel over SR 43, the BNSF Railway, and the Tule River. Dedicated wildlife crossing structures would be provided from approximately Cross Creek south to Avenue 136 in at-grade portions of the railroad embankment at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of each of the Cross Creek and Tule River crossings.

This alternative alignment would cross SR 43, Whitley Avenue/SR 137, and several local roads. SR 43, Waukena Avenue, and Whitley Avenue would be grade-separated from the HST with an overcrossing/undercrossing; other roads would be closed at the HST right-of-way.

E. ALLENSWORTH BYPASS ALTERNATIVE ALIGNMENT

The Allensworth Bypass Alternative Alignment would pass west of the BNSF Alternative, avoiding Allensworth Ecological Reserve and the Allensworth State Historic Park. This alignment was refined over the course of environmental studies to reduce impacts on wetlands and orchards. The total length of the Allensworth Bypass Alternative Alignment would be approximately 19 miles, beginning at Avenue 84 and rejoining the BNSF Alternative at Elmo Highway.

The Allensworth Bypass Alternative would be constructed on an elevated structure only where the alignment crosses the Alpaugh railroad spur and Deer Creek. The alignment would pass through Tulare County mostly at-grade. Dedicated wildlife crossing structures would be provided from approximately Avenue 84 to Poso Creek at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of both the Deer Creek and Poso Creek crossings.

The Allensworth Bypass would cross County Road J22, Scofield Avenue, Garces Highway, Woollomes Avenue, Magnolia Avenue, Palm Avenue, Pond Road, Peterson Road, and Elmo Highway. Woollomes Avenue and Elmo Highway would be closed at the HST right-of-way, while the other roads would be realigned and/or grade-separated from the HST with overcrossings.

The Allensworth Bypass Alternative includes an option to relocate the existing BNSF Railway tracks to be adjacent to the HST right-of-way for the length of this alignment. The possibility of relocating the BNSF Railway tracks along this alignment has not yet been discussed with BNSF Railway; however, if this option is selected, it is assumed that the existing BNSF Railway right-of-way would be abandoned between Avenue 84 and Elmo Highway, and the relocated BNSF Railway right-of-way would be 100 feet wide and adjacent to the eastern side of the Allensworth Bypass Alternative right-of-way.

F. WASCO-SHAFTER BYPASS ALTERNATIVE ALIGNMENT

The Wasco-Shafter Bypass Alternative Alignment would diverge from the BNSF Alternative between Sherwood Avenue and Fresno Avenue, crossing over to the eastern side of the BNSF Railway tracks and bypassing Wasco and Shafter to the east. The Wasco-Shafter Bypass Alternative would be at-grade except where it travels over 7th Standard Road and the BNSF Railway to rejoin the BNSF Alternative. The total length of the alternative alignment would be approximately 24 miles.

The Wasco-Shafter Bypass was refined to avoid the Occidental Petroleum tank farm as well as a historic property potentially eligible for listing on the National Register of Historic Places. The Wasco-Shafter Bypass would cross SR 43, SR 46, East Lerdo Highway, and several local roads. SR 46, Kimberlina Road, Shafter Avenue, Beech Avenue, Cherry Avenue, and Kratzmeyer Road would be grade-separated from the HST with overcrossings/undercrossings; other roads would be closed at the HST right-of-way.

G. BAKERSFIELD SOUTH ALTERNATIVE ALIGNMENT

From the Rosedale Highway (SR 58) in Bakersfield, the Bakersfield South Alternative Alignment would run parallel to the BNSF Alternative Alignment at varying distances to the north. At Chester Avenue, the Bakersfield South Alternative curves south, and runs parallel to California Avenue. As with the BNSF Alternative, the Bakersfield South Alternative would begin at grade and become elevated starting at Palm Avenue through Bakersfield to its terminus at the southern end of the Bakersfield station tracks. The elevated section would range in height from 50 to 70 feet. Dedicated wildlife crossing structures would be placed between 100 and 500 feet to the north and south of the Kern River.

The Bakersfield South Alternative would be approximately 9 miles long and would cross the same roads as the BNSF Alternative. This alternative includes the Bakersfield Station–South Alternative.

2.2.2 Station Alternatives

The Fresno to Bakersfield HST Section would include a new station in Fresno and a new station in Bakersfield. An optional third station, the Kings/Tulare Regional Station, is under consideration.

Stations would be designed to address the purpose of the HST, particularly to allow for intercity travel and connection to local transit, airports, and highways. Stations would include the station platforms, a station building and associated access structure, as well as lengths of bypass tracks to accommodate local and express service at the stations. All stations would contain the following elements:

- Passenger boarding and alighting platforms.
- Station head house with ticketing, waiting areas, passenger amenities, vertical circulation, administration and employee areas, and baggage and freight-handling service.
- Vehicle parking (short-term and long-term) and "kiss and ride[1]".
- Motorcycle/scooter parking.
- Bicycle parking.
- Waiting areas and queuing space for taxis and shuttle buses.
- Pedestrian walkway connections.

A. FRESNO STATION ALTERNATIVES

Two alternative sites are under consideration for the Fresno Station.

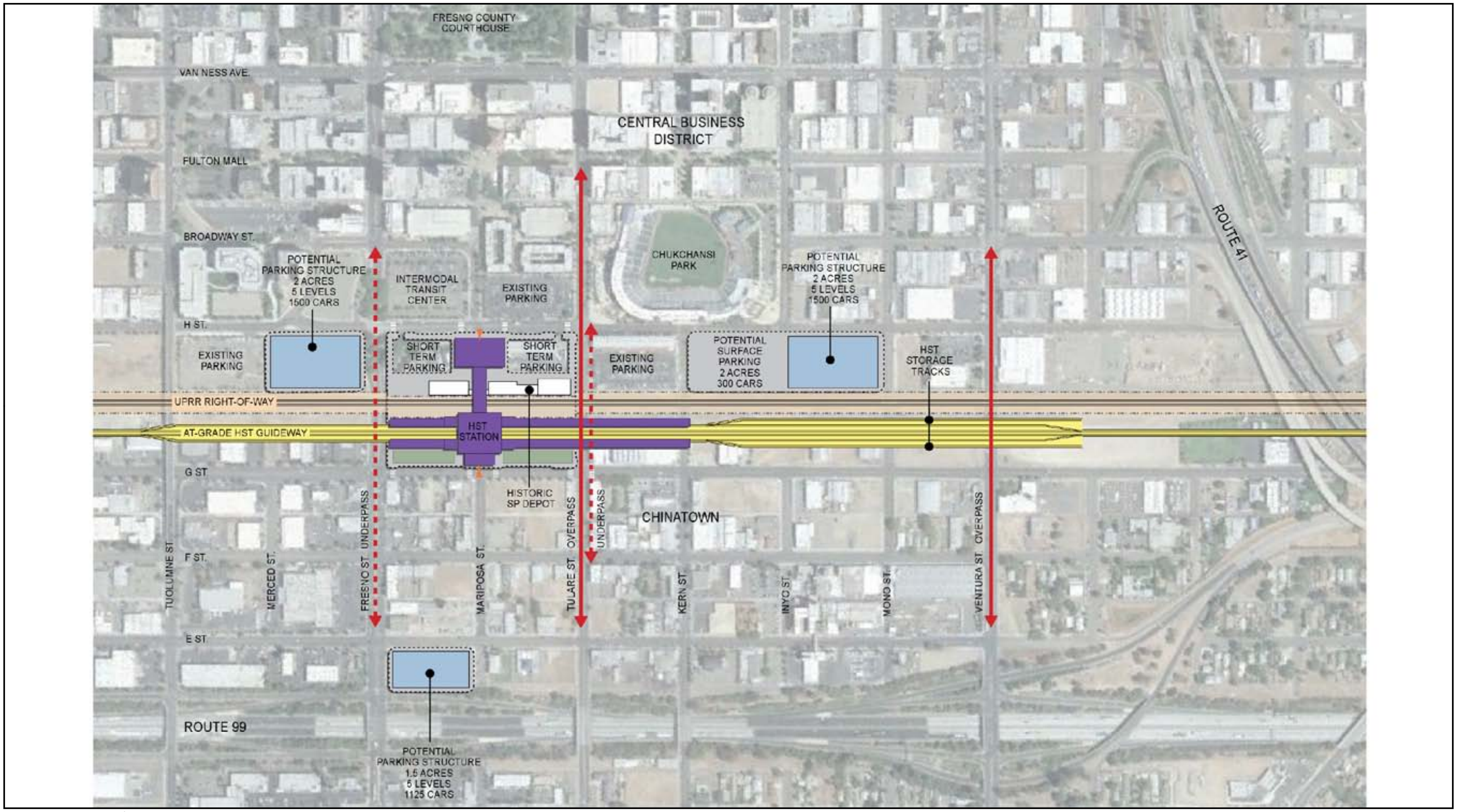
Fresno Station–Mariposa Alternative

The Fresno Station–Mariposa Alternative would be in downtown Fresno, less than 0.5 mile east of SR 99 on the BNSF Alternative. The station would be centered on Mariposa Street and bordered by Fresno Street on the north, Tulare Street on the south, H Street on the east, and G Street on the west. The station building would be approximately 75,000 square feet, with a maximum height of approximately 64 feet.

The two-level station would be at-grade; with passenger access provided both east and west of the HST guideway and the UPRR tracks, which would run parallel with one another adjacent to the station. The first level would contain the public concourse, passenger service areas, and station and operation offices. The second level would include the mezzanine, a pedestrian overcrossing above the HST guideway and the UPRR tracks, and an additional public concourse area. Entrances would be located at both G and H streets. A conceptual site plan of the Fresno Station–Mariposa Alternative is provided in Figure 2-2.

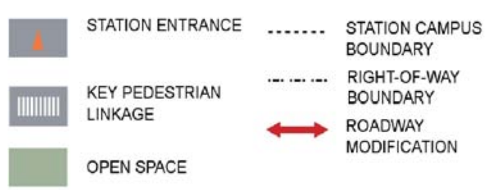
The majority of station facilities would be east of the UPRR tracks. The station and associated facilities would occupy approximately 20.5 acres, including 13 acres dedicated to the station, short term parking, and kiss-and-ride accommodations. A new intermodal facility, not a part of this proposed undertaking, would be located on the parcel bordered by Fresno Street to the north, Mariposa Street to the south, Broadway Street to the east, and H Street to the west (designated "Intermodal Transit Center" in Figure 2-2). Among other uses, the intermodal facility would accommodate the Greyhound facilities and services that would be relocated from the northwestern corner of Tulare and H streets.

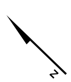
[1] "Kiss and ride" refers to the station area where riders may be dropped off or picked up before or after riding the HST.



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011





NOT TO SCALE

Figure 2-2
Fresno Station-Mariposa Alternative

The site proposal includes the potential for up to three parking structures occupying a total of approximately 5.5 acres. Two of the three potential parking structures would each sit on 2 acres, and each would have a capacity of approximately 1,500 cars. The third parking structure would be slightly smaller in footprint (1.5 acres), with five levels and a capacity of approximately 1,100 cars. An additional 2-acre surface parking lot would provide approximately 300 parking spaces.

Under this alternative, the historic Southern Pacific Railroad depot and associated Pullman Sheds would remain intact. While these structures could be used for station-related purposes, they are not assumed to be functionally required for the HST project and are thus, not proposed to be physically altered as part of the project. The Mariposa station building footprint has been configured to preserve views of the historic railroad depot and associated sheds.

Fresno Station–Kern Alternative

The Fresno Station–Kern Alternative would be similarly situated in downtown Fresno and would be located on the BNSF Alternative, centered on Kern Street between Tulare Street and Inyo Street (Figure 2-3). This station would include the same components as the Fresno Station–Mariposa Alternative, but under this alternative, the station would not encroach on the historic Southern Pacific Railroad depot just north of Tulare Street and would not require relocation of existing Greyhound facilities.

The station building would be approximately 75,000 square feet, with a maximum height of approximately 64 feet. The station building would have two levels housing the same facilities as the Fresno Station–Mariposa Alternative (UPRR tracks, HST tracks, mezzanine, and station office). The approximately 18.5-acre site would include 13 acres dedicated to the station, bus transit center, short term parking, and kiss-and-ride accommodations.

Two of the three potential parking structures would each sit on 2 acres, and each would have a capacity of approximately 1,500 cars. The third structure would be slightly smaller in footprint (1.5 acres) and have a capacity of approximately 1,100 cars. Surface parking lots would provide approximately 600 additional parking spaces. Like the Fresno Station–Mariposa Alternative, the majority of station facilities under the Kern Alternative would be sited east of the HST tracks.

B. KINGS/TULARE REGIONAL STATION

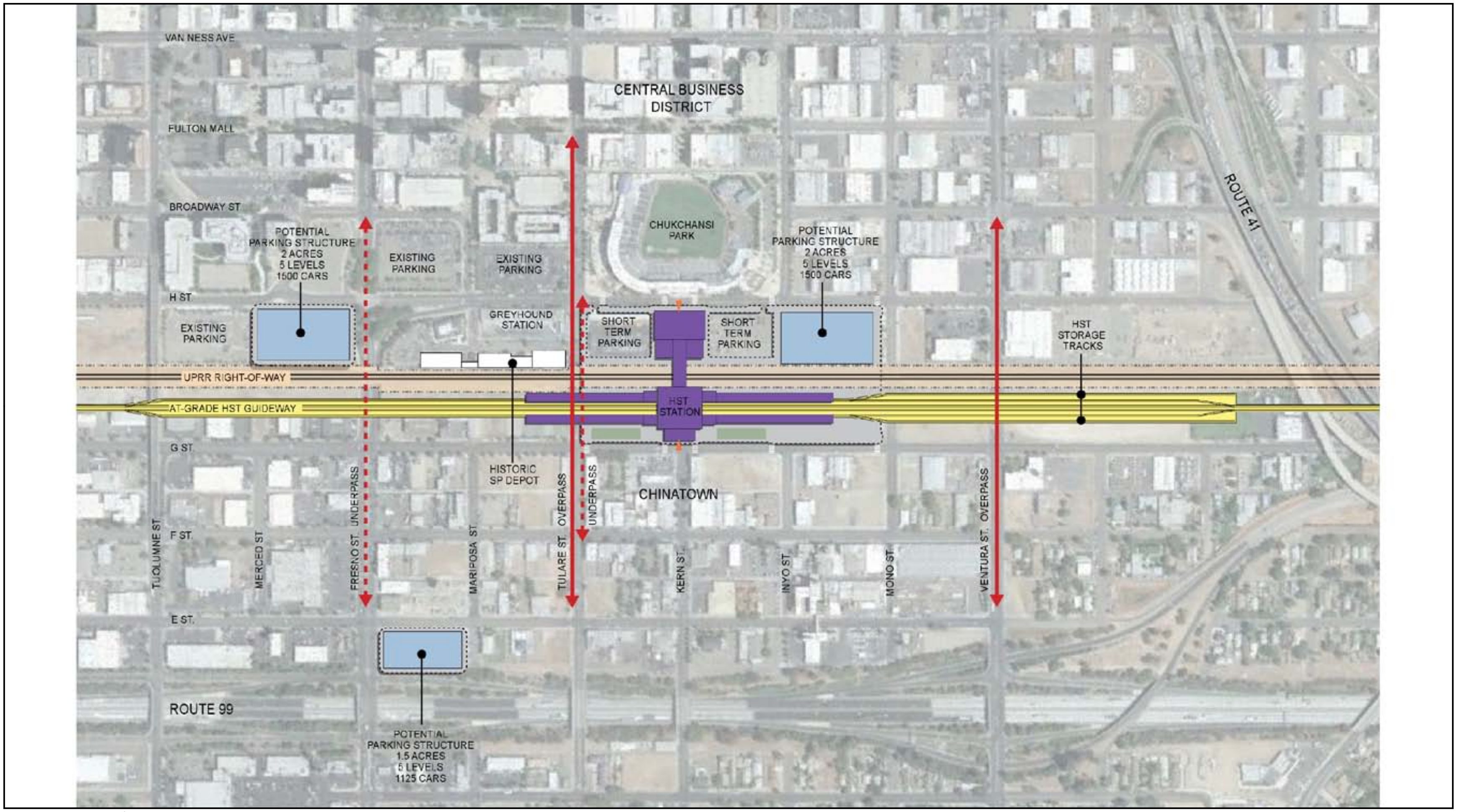
The potential Kings/Tulare Regional Station would be located east of SR 43 (Avenue 8) and north of the Cross Valley Rail Line (San Joaquin Valley Railroad) (Figure 2-4). The station building would be approximately 40,000 square feet with a maximum height of approximately 75 feet. The entire site would be approximately 27 acres, including 8 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional approximately 19 acres would support a surface parking lot with approximately 1,600 spaces.

C. BAKERSFIELD STATION ALTERNATIVES

Two options are under consideration for the Bakersfield Station.

Bakersfield Station–North Alternative

The Bakersfield Station–North Alternative would be located at the corner of Truxtun and Union Avenue/SR 204 along the BNSF Alternative Alignment (Figure 2-5). The three-level station building would be 52,000 square feet, with a maximum height of approximately 95 feet. The first level would house station operation offices and would also accommodate trains running along the



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

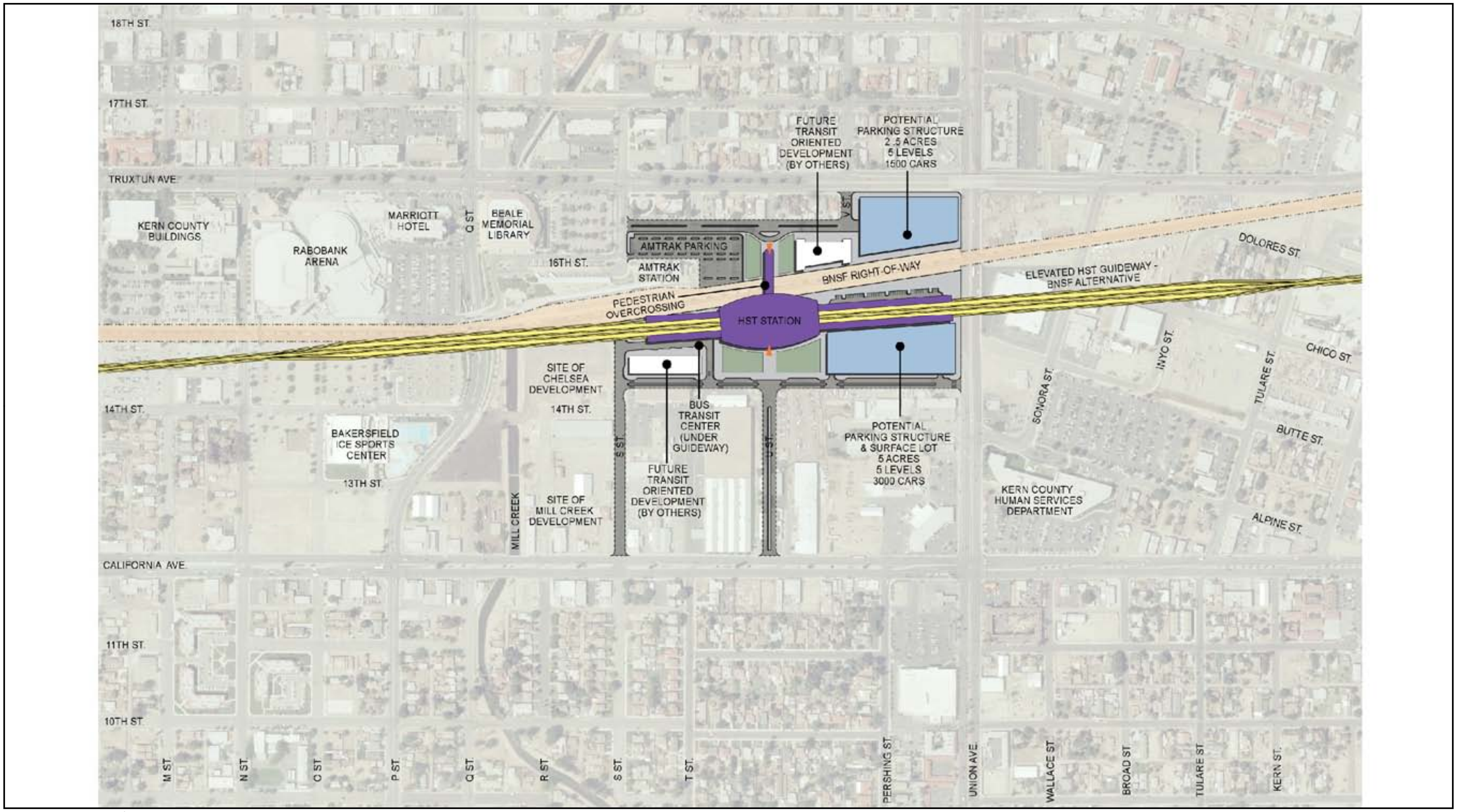
Figure 2-3
Fresno Station-Kern Alternative

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

Figure 2-4
Kings/Tulare Regional Station (potential)



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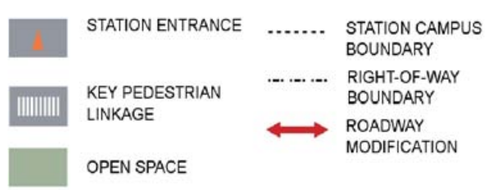
May 16, 2011



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NOT TO SCALE

Figure 2-5
Bakersfield Station-North Alternative

BNSF Railway line. The second level would include the mezzanine; the HST platforms and guideway would pass through the third level. Under this alternative, the station building would be located at the western end of the parcel footprint. Two new boulevards would be constructed to access the station and the supporting facilities.

The 19-acre site would designate 11.5 acres for the station, bus transit center, short-term parking, and kiss-and-ride. An additional 7.5 acres would house two parking structures that together would accommodate approximately 4,500 cars. The bus transit center and the smaller of the two parking structures (2.5 acres) would be located north of the HST tracks. The BNSF Railway line would run through the station at-grade, with the HST alignment running on an elevated guideway.

Bakersfield Station–South Alternative

The Bakersfield Station–South Alternative would be would be similarly located in downtown Bakersfield, but situated on the Bakersfield South Alternative Alignment along Union and California avenues, just south of the BNSF Railway right-of-way (Figure 2-6). The two-level station building would be 51,000 square feet, with a maximum height of approximately 95 feet. The first floor would house the concourse, and the platforms and the guideway would be on the second floor. Access to the site would be from two new boulevards, one branching off from California Avenue and the other from Union Avenue.

The entire site would be 20 acres, with 15 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional 5 acres would support one six-level parking structure with a capacity of approximately 4,500 cars. Unlike the Bakersfield Station–North Alternative, this station site would be located entirely south of the BNSF Railway right-of-way.

2.2.3 Heavy Maintenance Facility (HMF)

One HST heavy vehicle maintenance and layover facility would be sited along either the Merced to Fresno or Fresno to Bakersfield HST section. Before the startup of initial operations, the HMF would support the assembly, testing, commissioning, and acceptance of high-speed rolling stock. During regular operations, the HMF would provide maintenance and repair functions, activation of new rolling stock, and train storage. The HMF concept plan indicates that the site would encompass approximately 150 acres to accommodate shops, tracks, parking, administration, roadways, power substation, and storage areas. The HMF would include tracks that allow trains to enter and leave under their own electric power or under tow. The HMF would also have management, administrative, and employee support facilities. Up to 1,500 employees could work at the HMF during any 24-hour period.

The Authority has determined that one HMF would be located between Merced and Bakersfield; however, the specific location has not yet been finalized. Five HMF sites are under consideration in the Fresno to Bakersfield Section (Figure 2-1):

- The Fresno Works–Fresno HMF site lies within the southern limits of the city of Fresno and county of Fresno next to the BNSF Railway right-of-way between SR 99 and Adams Avenue. Up to 590 acres are available for the facility at this site.
- The Kings County–Hanford HMF site lies southeast of the city of Hanford, adjacent to and east of SR 43, between Houston and Idaho Avenues. Up to 510 acres are available at the site.
- The Kern Council of Governments–Wasco HMF site lies directly east of Wasco between SR 46 and Filburn Street. Up to 420 acres are available for the facility at this site.

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

STATION ENTRANCE	STATION CAMPUS BOUNDARY
KEY PEDESTRIAN LINKAGE	RIGHT-OF-WAY BOUNDARY
OPEN SPACE	ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 2-6
Bakersfield Station-South Alternative

- The Kern Council of Governments–Shafter East HMF site lies in the city of Shafter between Burbank Street and 7th Standard Road to the east of the BNSF Railway right-of-way. This site has up to 490 acres available for the facility.
- The Kern Council of Governments–Shafter West HMF site lies in the city of Shafter between Burbank Street and 7th Standard Road to the west of the BNSF Railway right-of-way. This site has up to 480 acres available for the facility.

2.3 Power

To provide power for the HST, high-voltage electricity at 115 kV and above would be drawn from the utility grid and transformed down to 25,000 volts. The voltage would then be distributed to the trains via an overhead catenary system. The project would not include the construction of a separate power source, although it would include the extension of power lines to a series of power substations positioned along the HST corridor. The transformation and distribution of electricity would occur in three types of stations:

- Traction power supply stations (TPSSs) transform high-voltage electricity supplied by public utilities to the train operating voltage. TPSSs would be sited adjacent to existing utility transmission lines and the HST right-of-way, and would be located approximately every 30 miles along the route. Each TPSS would be 200 feet by 160 feet.
- Switching stations connect and balance the electrical load between tracks, and switch power on or off to tracks in the event of a power outage or emergency. Switching stations would be located midway between, and approximately 15 miles from, the nearest TPSS. Each switching station would be 120 feet by 80 feet and located adjacent to the HST right-of-way.
- Paralleling stations, or autotransformer stations, provide voltage stabilization and equalize current flow. Paralleling stations would be located every 5 miles between the TPSSs and the switching stations. Each paralleling station would be 100 feet by 80 feet and located adjacent to the HST right-of-way.

2.4 Project Construction

The construction plan developed by the Authority and described below would maintain eligibility for eligibility for federal American Recovery and Reinvestment Act (ARRA) funding. For the Fresno to Bakersfield Section, specific construction elements would include at-grade, below-grade, and elevated track, track work, grade crossings, and installation of a positive train control system. At-grade track sections would be built using conventional railroad construction techniques. A typical sequence includes clearing, grubbing, grading, and compacting of the rail bed; application of crushed rock ballast; laying of track; and installation of electrical and communications systems.

The precast segmental construction method is proposed for elevated track sections. In this construction method, large concrete bridge segments would be mass-produced at an onsite temporary casting yard. Precast segments would then be transported atop the already completed portions of the elevated track and installed using a special gantry crane positioned on the aerial structure. Although the precast segmental method is the favored technique for aerial structure construction, other methods may be used, including cast-in-place, box girder, or precast span-by-span techniques.

Pre-construction activities would be conducted during final design and include geotechnical investigations, identification of staging areas, initiation of site preparation and demolition, relocation of utilities, and implementation of temporary, long-term, and permanent road closures.

Additional studies and investigations to develop construction requirements and worksite traffic control plans would be conducted as needed.

Major construction activities for the Fresno to Bakersfield Section would include earthwork and excavation support systems construction, bridge and guideway construction, railroad systems construction (including trackwork, traction electrification, signaling, and communications), and station construction. During peak construction periods, work is envisioned to be underway at several locations along the route, with overlapping construction of various project elements. Working hours and workers present at any time will vary depending on the activities being performed.

The Authority intends to build the project using sustainable methods that:

- Minimize the use of nonrenewable resources.
- Minimize the impacts on the natural environment.
- Protect environmental diversity.
- Emphasize the use of renewable resources in a sustainable manner.

The overall schedule for construction is provided in Table 2-1.

Table 2-1
Construction Schedule

Activity	Tasks	Duration
Mobilization	Safety devices and special construction equipment mobilization	March–October 2013
Site Preparation	Utilities relocation; clearing/grubbing right-of-way; establishment of detours and haul routes; preparation of construction equipment yards, stockpile materials, and precast concrete segment casting yard	April–August 2013
Earthmoving	Excavation and earth support structures	August 2013–August 2015
Construction of Road Crossings	Surface street modifications, grade separations	June 2013–December 2017
Construction of Elevated Structures	Elevated structure and bridge foundations, substructure, and superstructure	June 2013–December 2017
Track Laying	Includes backfilling operations and drainage facilities	January 2014–August 2017
Systems	Train control systems, overhead contact system, communication system, signaling equipment	July 2016–November 2018
Demobilization	Includes site cleanup	August 2017–December 2019

Table 2-1
Construction Schedule

Activity	Tasks	Duration
HMF Phase 1[a]	Test track assembly and storage	August–November 2017
Maintenance-of-Way Facility	Potentially co-located with HMF[a]	January–December 2018
HMF Phase 2[a]	Test track light maintenance facility	June–December 2018
HMF Phase 3[a]	Heavy Maintenance Facility	January–July 2021
HST Stations	Demolition, site preparation, foundations, structural frame, electrical and mechanical systems, finishes	Fresno: December 2014–October 2019 Kings/Tulare Regional: TBD[b] Bakersfield: January 2015–November 2019

Notes:
[a] The HMF would be sited along either the Merced to Fresno or Fresno to Bakersfield section.
[b] ROW would be acquired for the Kings/Tulare Regional Station; however, the station itself would not be part of initial construction.
Acronym: TBD = to be determined

Chapter 3.0
Regulatory Framework

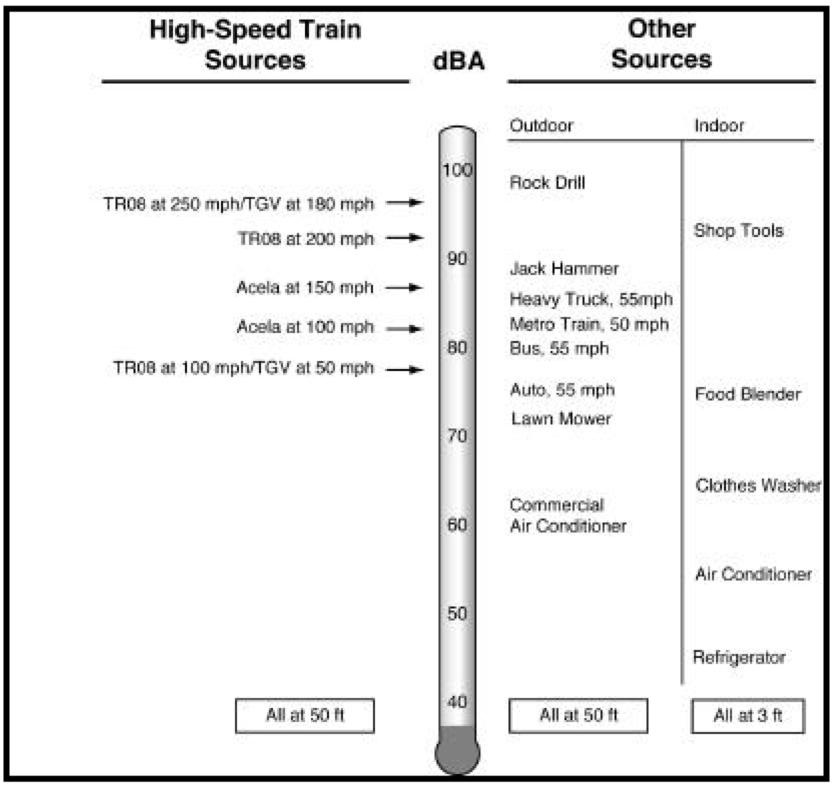
3.0 Regulatory Framework

3.1 Noise and Vibration Descriptors

This section identifies the basic descriptors and metrics used to quantify noise and vibration and to assess associated impacts in this report. Appendix A provides further background information regarding HST noise and vibration. Much of this section has been adapted from the FRA's *High-Speed Ground Transportation Noise and Vibration Impact Assessment* manual (FRA 2005).

3.1.1 Noise Descriptors

The universal descriptor used for environmental noise is the A-weighted sound pressure level. It describes the level of noise measured at a receiver at any moment in time and is read directly from noise monitoring equipment, with the weighting switch set on "A." Figure 3-1 shows typical A-weighted sound levels for high-speed ground transportation and other sources. The high-speed ground transportation sources are described further in Appendix A.



Source: FRA 2005

Figure 3-1
Typical A-weighted sound pressure levels

As shown on Figure 3-1, typical A-weighted sound levels range from the 40s to the 90s, where 40 is very quiet and 90 is very loud. The scale in the figure is labeled "dBA" to denote the way A-weighted sound levels are typically written. The letters "dB" stand for "decibels" and refer to the general strength of the noise. The letter "A" indicates that the sound has been filtered to reduce the strength of very low and very high-frequency sounds, much as the human ear does. Without this A-weighting, noise monitoring equipment would respond to events people cannot hear, such as high frequency dog whistles and low-frequency seismic disturbances. On the average, each A-weighted sound level increase of 10 decibels corresponds to an approximate doubling of subjective loudness. A summary of the fundamentals of noise related to high-speed transit is given in Appendix A.

This report uses the following single-number descriptors; all based on the A-weighted sound pressure level as the fundamental unit for environmental noise measurements, computations, and assessment:

The **maximum sound level (L_{max})** refers to the maximum observed or recorded noise level during a single noise event or measurement period. There are two standard ways of obtaining the Lmax, one using the "fast" response setting on the sound level meter, or Lmax,fast (obtained by using a 0.125 second averaging time), and the other using the "slow" setting, or Lmax,slow (obtained by using a 1 second averaging time). Lmax,fast can occur arbitrarily and is usually caused by a single component on a moving train, often a defective component such as a flat spot on a wheel. As a result, inspectors from the FRA use Lmax,fast to identify excessively noisy locomotives and rail cars during enforcement of Railroad Noise Emission Compliance Regulations. Lmax,slow, with its greater averaging time, tends to de-emphasize the effects of non-representative impacts and impulses and is generally better correlated with the Sound Exposure Level, defined below, which is the basis of impact assessment. Thus, Lmax,slow is typically used for modeling train noise mathematically. In general, however, the L_{max} descriptor in either form is not recommended for noise impact assessment because it is used in vehicle -noise specifications and commonly measured for individual vehicles.

The **sound exposure level** (**SEL)** refers to a receiver's cumulative noise exposure from a single noise event. It is represented by the total A-weighted sound energy during the event, normalized to a one-second interval. SEL is the primary descriptor of high-speed rail vehicle noise emissions and an intermediate value in the calculation of both Leq and Ldn (defined below).

The **equivalent sound level (L**eq**)** refers to a receiver's energy-averaged noise exposure from all events over a specified period (e.g., 1 minute, 1 hour, 24 hours). The Leq for a 1-hour period may be indicated as Leq(1-h) or Leq(h). The Leq value for the 15-hour daytime period (7 a.m. to 10 p.m.) is described as Leq(d) and the 9-hour nighttime period (10 p.m. to 7 a.m.) as Leq(n). L_{eq} is generally used in this document to report results of short-term noise measurements (usually ranging between 20 minutes and 1 hour). The measured or estimated Leq(1-h), or Leq(d) values are generally used to assess noise impacts for non-residential land uses with daytime-only uses.

The **day-night sound level (L**dn**)** refers to a receiver's energy-averaged noise exposure from all events over a 24-hour period with a penalty added for nighttime noise periods. The basic unit used in calculating Ldn is the Leq(h) for each one-hour period. It may be thought of as a noise exposure, totaled after increasing all nighttime A-weighted levels (between 10 p.m. and 7 a.m.) by 10 decibels to take into account the increased sensitivity of most people to nighttime noise. Every noise event during the 24-hour period increases this exposure, louder events more than quieter events, and events that are of longer duration more than briefer events. In this report, Ldn is used to assess noise for residential land uses. Typical community Ldn values range from about 50 to 70 dBA, where 50 dBA represents a quiet noise environment and 70 dBA is a noisy one.

The **Community Noise Equivalent Level (CNEL)** is a community noise descriptor frequently used in California. CNEL is calculated in a manner similar to Ldn except with an additional 5 dBA penalty added for evening hours (between 7 p.m. and 10 p.m.), to take into account residential evening activities. CNEL values are generally within about 1 dBA of Ldn values measured for the same noise environments.

3.1.2 Vibratory Motion

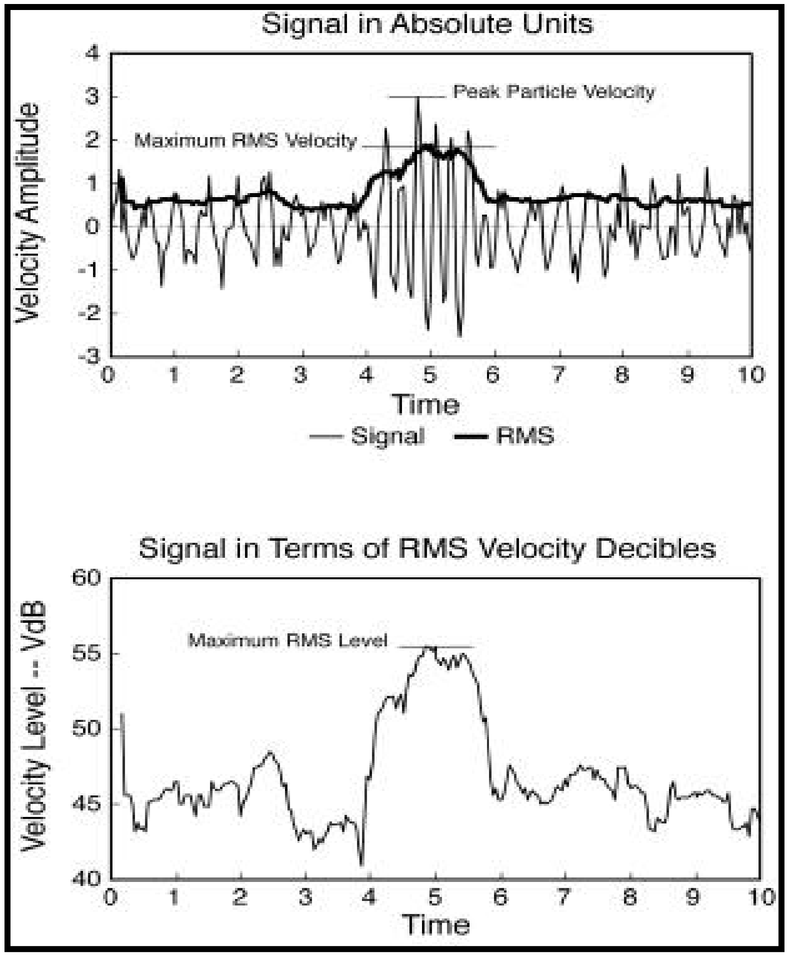
Vibration is an oscillatory motion, which can be described in terms of displacement, velocity, or acceleration. Because the motion is oscillatory, there is no net movement of the vibration element, and the average of any of the motion descriptors is zero. Displacement is the easiest descriptor to understand. For a vibrating floor, the displacement is simply the distance that a point on the floor moves away from its static position. The velocity represents the instantaneous speed of the floor movement, and acceleration is the rate of change of the speed.

Although displacement is easier to understand than velocity or acceleration, it is rarely used to describe ground-borne vibration. This is because most transducers used for measuring ground-borne vibration use either velocity or acceleration, and, even more important, the response of humans, buildings, and equipment to vibration is more accurately described using velocity or acceleration.

A. AMPLITUDE DESCRIPTORS

Vibration consists of rapidly fluctuating motions with an average motion of zero. The various methods used to quantify vibration amplitude are shown on Figure 3-2. The raw signal is the lighter weight curve in the top graph of this figure. This is the instantaneous vibration velocity, which fluctuates about the zero point. The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV often is used in monitoring blasting vibration because it is related to the stresses that are experienced by buildings.

Although PPV is appropriate for evaluating the potential of building damage, it is not suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. Because the net average of a vibration signal is zero, the root mean square (RMS) amplitude is used to describe the "smoothed" vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal. The average is typically calculated over a 1-econd period. The RMS amplitude is shown superimposed on the vibration signal on Figure 3-2. The RMS amplitude is always less than the PPV and is always positive. The ratio of PPV to maximum RMS amplitude is defined as the crest factor for the signal. The crest factor is always greater than 1.71, although a crest factor of 8 or more is not unusual for impulsive signals. For ground-borne vibration from trains, the crest factor is usually 4 to 5.



Source: FRA 2005

Figure 3-2
Different methods of describing a vibration signal

The PPV and RMS velocities are normally described in inches per second in the United States. Although it is not universally accepted, decibel notation is in common use for vibration. Decibel notation serves to compress the range of numbers required to describe vibration. The bottom graph on Figure 3-2 shows the RMS curve of the top graph expressed in decibels. Vibration velocity level in decibels is defined as:

$$L_v = 20 \times \text{Log}_{10} (v/v_{ref})$$

where "L_v" is the velocity level in decibels, "v" is the RMS velocity amplitude, and "v_{ref}" is the reference velocity amplitude. A reference always must be specified whenever a quantity is expressed in terms of decibels. The accepted reference quantity for vibration velocity level in the United States is $1x10^{-6}$ in./sec.; however, it is important to state clearly the reference quantity being used whenever velocity levels are specified. All vibration levels in this report are referenced to $1x10^{-6}$ in./sec. Although not a universally accepted notation, the abbreviation "VdB" (RMS vibration velocity level, decibels) is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

B. GROUND-BORNE NOISE

The rumbling sound caused by the vibration of room surfaces is called ground-borne noise. The annoyance potential of ground-borne noise is usually characterized using the A-weighted sound level. Although the A-weighted level is typically the only descriptor used for community noise, there are potential problems with characterizing low-frequency noise using A-weighting. This is because of the non-linearity of human hearing, which causes sounds dominated by low-frequency components to seem louder than broadband sounds that have the same A-weighted level. The result is that a ground-borne noise level of 40 dBA sounds louder than 40 dBA broadband airborne noise. This anomaly is accounted for by setting the limits for ground-borne noise lower than would be the case for broadband noise.

Ground-borne noise is generally only an issue for trains operating under ground. For systems where the train is operating either at or above grade, the airborne noise level is generally significantly louder than the ground-borne component, so that the ground-borne noise is masked by the airborne noise. This will be the case for this portion of the project as there will be no sections of track run below grade.

3.2 Noise Laws, Regulations, and Orders

3.2.1 Federal

A. NATIONAL ENVIRONMENTAL POLICY ACT (42 U.S.C. 4321, ET SEQ.) (P.L. 91-190) (40 CFR 1506.5)

NEPA established national environmental policy, including a multidisciplinary approach to considering potential environmental impacts in federal government agency decision making. The law requires federal agencies to prepare an EIS to accompany reports to and recommendations for funding from Congress. Thus, before implementing any "major" or "significant" or "federal" action, the agency must consider the environmental impacts of that action and alternatives (including "no action"), identify unavoidable environmental impacts, and make this information available to the public in the EIS. Hydrological/geological, biological/ecological, social, health, archeological, historical, and cultural consequences are typically considered for an action. When anticipated, potential noise impacts can also be considered in the process. For instance, noise and vibration levels may influence human health, wildlife habitats, and the structural integrity of historic buildings and archaeological or paleontological resources. It is for these reasons that potential impacts from the proposed HST, an obvious generator of noise and vibration, are considered in this EIS.

In addition to the EIS requirement, the National Environmental Policy Act statute also establishes a broad mandate for federal agencies to incorporate environmental protection and enhancement measures into the programs and projects they help finance. For example, unlike what is contained in the NEPA statute, the Federal Transit Laws provide a more explicit statutory mandate for mitigating adverse noise impacts. Before approving a construction grant, the Federal Transit Administration (FTA) must make a finding that "(ii) the preservation and enhancement of the environment, and the interest of the community in which a project is located, were considered; and (iii) no adverse environmental effect is likely to result from the project, or no feasible and prudent alternative to the effect exists and all reasonable steps have been taken to minimize the effect." (49 U.S.C. 5324[b][3][A]).

B. NOISE CONTROL ACT OF 1972 (42 U.S.C. 4910)

The Noise Control Act of 1972 was the first comprehensive statement of national noise policy. It declared "it is the policy of the U.S. to promote an environment for all Americans free from noise that jeopardizes their health or welfare." Although the Act, as a funded program, was ultimately abandoned at the federal level, it served as the catalyst for comprehensive noise studies and the generation of noise assessment and mitigation policies, regulations, ordinances, standards and guidance for many states, counties and even municipal governments. For example, the "noise elements" of community general plan documents and local noise ordinances studied as part of this EIS were largely created in response to passage of the Act.

C. FRA GUIDELINES

The FRA guidelines for assessing noise and vibration impacts from high-speed trains (FRA 2005) are adapted from the same sources used in the FTA guidelines for rail projects and their associated stationary facilities (FTA 2006). Those criteria will be discussed in the following section.

Noise impacts on wildlife and livestock are not found in the FTA guidance document, but are addressed in the FRA guidelines. As shown in Table 3-1, the usage of sound exposure level as an applicable noise metric for wildlife and livestock noise impact assessment seems consistent with available but limited research that suggests animals startle when exposed to noises (e.g., sudden aircraft overflights) for which they have not developed sufficient habituation.

Table 3-1
Interim Criteria for High-Speed Train Noise Effects on Animals

Animal Category	Class	Noise Metric	Noise Level (dBA)
Domestic	Mammals (Livestock)	SEL	100
	Birds (Poultry)	SEL	100
Wild	Mammals	SEL	100
	Birds	SEL	100

dBA = A-weighted decibels
SEL = Sound Exposure Level
Source: FRA 2005.

In a manner identical to language in Chapter 12 of the FTA guidelines, the FRA also provides guidelines for assessment criteria for construction noise. These are shown in Table 3-2.

Table 3-2
FRA Construction Noise Assessment Criteria

Land Use	8-hour L_{eq} (dBA)		L_{dn} (dBA)
	Day	Night	30-day Average
Residential	80	70	75a
Commercial	85	85	80b
Industrial	90	90	85b

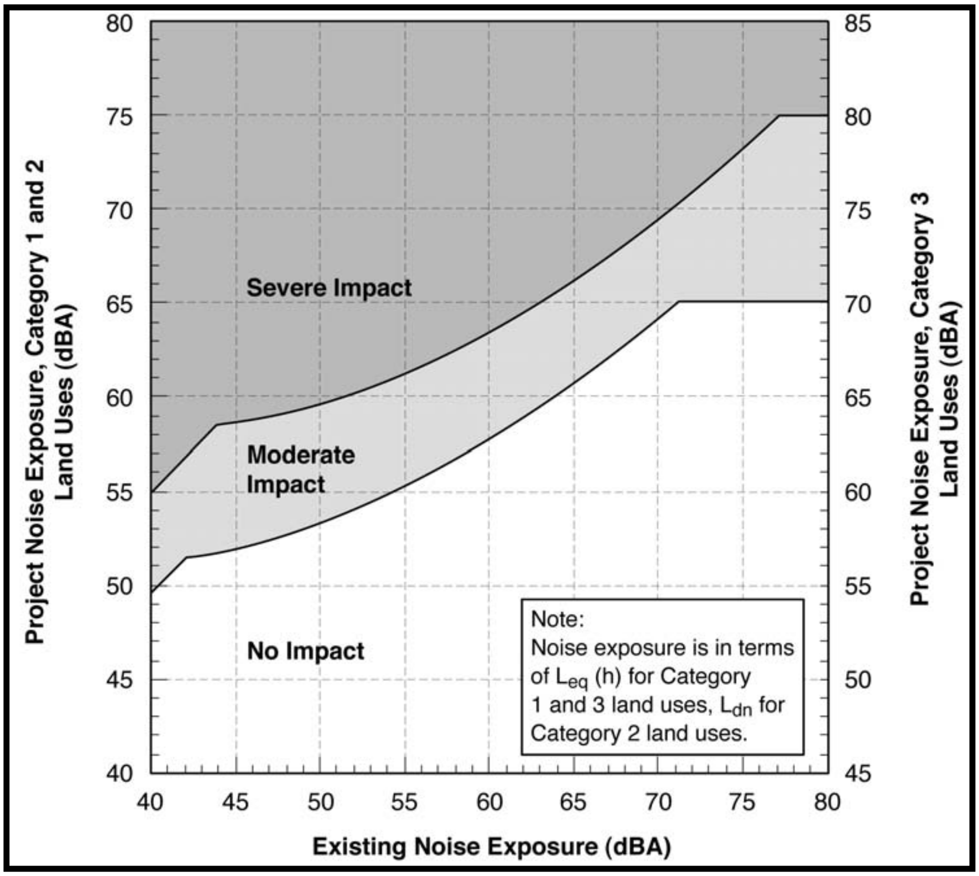
Notes:
[a] In urban areas with very high ambient noise levels (Ldn > 65 dB), Ldn from construction operations should not exceed existing ambient noise levels + 10 dB.
[b] Twenty-four-hour Leq, not Ldn.
dBA = A-weighted decibels
Ldn = day-night sound level, dBA
Leq = equivalent sound level, dBA
Source: FRA 2005.

The values presented in Table 3-2 are considered appropriate for a "detailed" impact assessment, which is appropriate for this EIR/EIS.

With respect to construction noise criteria, Section 10.1.2 of the FRA guidelines echoes both the lack of standardized federal-level compliance limits and the suggested threshold values for general and detailed-level analysis that appear in Section 12.1.3 of the FTA guidelines.

D. FTA GUIDELINES

The noise impact criteria for rail projects and their associated fixed facilities such as storage and maintenance yards, passenger stations and terminals, parking facilities, and substations are shown graphically on Figure 3-3 (FTA 2006).



Source: FTA 2006

Figure 3-3
Noise impact criteria for transit projects

The land use categories (1, 2, 3) shown on Figure 3-3 are defined in Table 3-3.

Table 3-3
Land Use Categories and Metrics for Transit Noise Impact Criteria

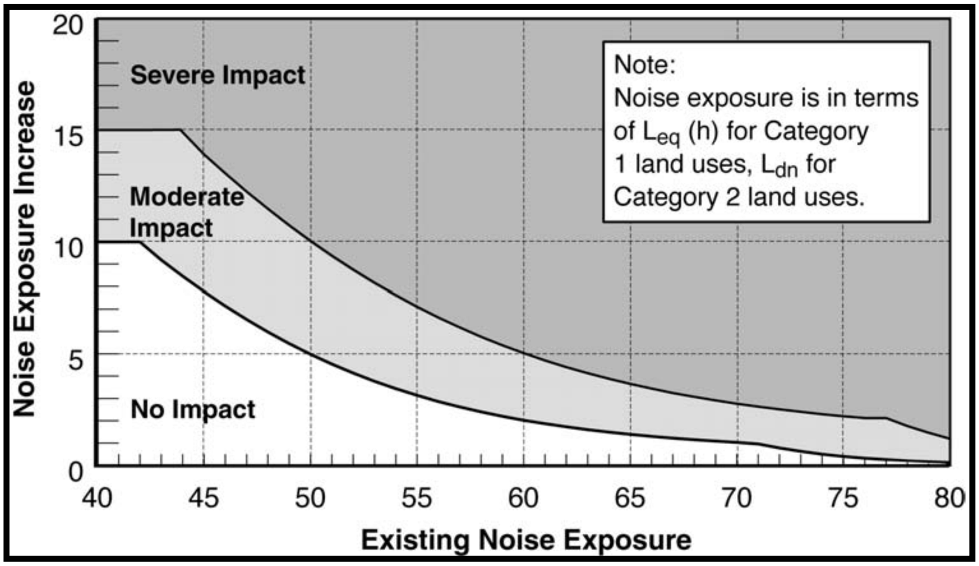
Land Use Category	Noise Metric* (dBA)	Land Use Category
1	Outdoor $L_{eq(h)}$**	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals where nighttime sensitivity to noise is assumed to be the utmost importance.
3	Outdoor $L_{eq(h)}$**	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls fall into this category, as well as places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Notes:
* Onset-rate adjusted sound levels (Leq, Ldn) are to be used where applicable.
** Leq for the noisiest hour of transit-related activity during hours of noise sensitivity.
dBA = A-weighted decibels
Ldn = day-night sound level, dBA
Leq(h) = equivalent sound level for a 1-hour period, dBA
Source: FTA 2006.

For noise exposures below the lower of the two curves on Figure 3-3, a proposed project is considered to have no noise impact since, on average, the introduction of the project will result in an insignificant increase in the number of people highly annoyed by the new noise. The curve defining the onset of noise impact stops increasing at 65 dB for Category 1 and 2 land use, a standard limit for an acceptable living environment defined by a number of federal, state, and local agencies. Project noise above the upper curve is considered to cause a severe impact because a significant percentage of people would be highly annoyed by the new noise. This curve flattens out at 75 dB for Category 1 and 2 land use, a level associated with an unacceptable living environment. As indicated by the right-hand scale on Figure 3-3, the project noise criteria are 5 decibels higher for Category 3 land uses because these types of land uses are considered to be slightly less sensitive to noise than the types of land uses in Categories 1 and 2.

Between the two curves the proposed project is judged to have a moderate impact. The change in the cumulative noise level is noticeable to most people, but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation, such as the existing noise level, predicted level of increase over existing noise levels, and the types and numbers of noise-sensitive land uses affected.

Although the curves on Figure 3-3 are defined in terms of the project noise exposure and the existing noise exposure, it is important to emphasize that it is the increase in the cumulative noise – when project-generated noise is added to existing noise levels – that is the basis for the criteria. The complex shapes of the curves are based on the considerations of cumulative noise increase described in Appendix A. To illustrate this point, Figure 3-4 shows the noise impact criteria for Category 1 and Category 2 land uses in terms of the allowable increase in the cumulative noise exposure. Since L_{dn} and L_{eq} are measures of total acoustic energy, any new noise source in a community will cause an increase, even if the new source level is less than the existing level. Referring to Figure 3-4, it can be seen that the criterion for moderate impact allows a noise exposure increase of 10 dBA if the existing noise exposure is 42 dBA or less, but only a 1 dBA increase when the existing noise exposure is 70 dBA.



Source: FTA 2006

Figure 3-4
Allowable increase in cumulative noise levels (Categories 1 & 2)

As the existing level of ambient noise increases, the allowable level of transit noise increases, but the total amount that community noise exposure is allowed to increase is reduced. This accounts for the unexpected result that a project noise exposure that is less than the existing noise exposure can still cause an impact. This is clearer from the examples given in Table 3-4, which indicate the level of transit noise allowed for different existing levels of exposure.

Table 3-4
Noise Impact Criteria: Effect on Cumulative Noise Exposure

L_{dn} or L_{eq} in dBA (rounded to nearest whole decibel)			
Existing Noise Exposure	**Allowable Project Noise Exposure**	**Allowable Combined Total Noise Exposure**	**Allowable Noise Exposure Increase**
45	51	52	7
50	53	55	5
55	55	58	3
60	57	62	2
65	60	66	1
70	64	71	1
75	65	75	0

dBA = A-weighted decibels
Ldn = Day-Night Sound Level, dBA
Leq = Equivalent Sound Level, dBA
Source: FTA 2006.

With respect to construction noise, there are no standard criteria that apply at the federal level. State and local noise criteria would apply. However, Section 12.1.3 of the FTA guidelines does offer suggested threshold values for two levels of analysis (general and detailed) that can help identify potential noise impacts from construction equipment (FTA 2006).

E. OSHA OCCUPATIONAL NOISE EXPOSURE (29 CFR 1910.95)

The Occupational Safety and Health Administration (OSHA) has regulated worker noise exposure to a time-weighted-average of 90 dBA over an 8-hour work shift. Areas where levels exceed 85 dBA must be designated and labeled as high-noise-level areas where hearing protection is required. This noise exposure criterion would apply to construction activities associated with the HST project. Noise from the HST project might also elevate noise levels at nearby construction sites to levels that exceed 85 dBA and thus trigger the need for administrative/engineering controls and hearing conservation programs as detailed by OSHA.

F. EPA RAILROAD NOISE EMISSION STANDARDS (40 CFR 201)

Interstate rail carriers must comply with noise emission standards that are enumerated as maximum measured noise levels in these federal regulations and summarized, with applicability to the HST project and for locomotives manufactured after 1979, as follows:

- 100 feet from geometric center of stationary locomotive, connected to a load cell and operating at any throttle setting except idle – 87 dBA (at idle setting, 70 dBA).
- 100 feet from geometric center of mobile locomotive – 90 dBA.
- 100 feet from geometric center of mobile railcars, at speeds of up to 45 mph– 88 dBA; or speeds greater than 45 mph– 93 dBA.

G. FRA RAILROAD NOISE EMISSION COMPLIANCE REGULATIONS (49 CFR 210)

The FRA’s Railroad Noise Emission Compliance Regulations (49 CFR Part 210) adopt and enforce the EPA’s railroad noise emission standards (40 CFR Part 201).

H. FEDERAL HIGHWAY ADMINISTRATION PROCEDURES FOR ABATEMENT OF HIGHWAY TRAFFIC NOISE AND CONSTRUCTION NOISE (23 CFR 772)

The Federal Highway Administration (FHWA) stipulates procedures and criteria for noise assessment studies of highway projects (23 CFR 772). It requires that noise abatement measures be considered on all major transportation projects if the project will cause a substantial increase in noise levels, or if projected noise levels approach or exceed the Noise Abatement Criteria (NAC) level for activities occurring on adjacent lands.

FHWA NAC for various land use ratings (called activity categories) are given Table 3-5. These noise criteria are assigned to exterior and interior activities. Noise attenuation provided by most residential structures leads to compliance with the interior design noise level if the exterior criterion is attained (USDOT and FHWA 1995).

Table 3-5
FHWA Noise Abatement Criteria

Activity Category	$L_{eq}(h)$	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: USDOT and FHWA 1995.

If these criteria sound levels are predicted to be approached or exceeded during the noisiest 1-hour period, noise abatement measures must be considered and, if found to be reasonable and feasible, they must be incorporated as part of the project. Consistent with FHWA guidelines, the California Department of Transportation (Caltrans) defines "approach" as a peak-noise-hour sound level of 66 dBA L_{eq}.

These criteria will be used starting in Section 6.5.4 when a detailed analysis is conducted of the change in peak hour noise due to increased traffic around the stations.

3.2.2 State

A. CEQA NOISE AND VIBRATION CRITERIA

Under CEQA, the specific impact significance measures and thresholds are left to local jurisdictions to set. Environmental concerns (e.g., clean air, noise) and thresholds of significance (e.g., parts per million of particulate matter, decibel level of noise) are not legislated under CEQA at the state level but left to the local jurisdiction to determine. For example, if one thinks that pedestrian safety is an environmentally significant concern, then that can be added to the list of significance measures evaluated in the environmental review practice, so long as it establishes a meaningful measure and threshold of significance, and substantial evidence of the environmental concern can be developed and cataloged.

With respect to noise and vibration, the following questions in Table 3-6 must be answered and a reasonable and sufficient justification must be provided for each answer.

Table 3-6
CEQA Noise Impact Assessment

XI. NOISE – Would the project result in:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	❒	❒	❒	❒
b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels?	❒	❒	❒	❒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	❒	❒	❒	❒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	❒	❒	❒	❒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	❒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	❒
Source: CEQA 2009.				

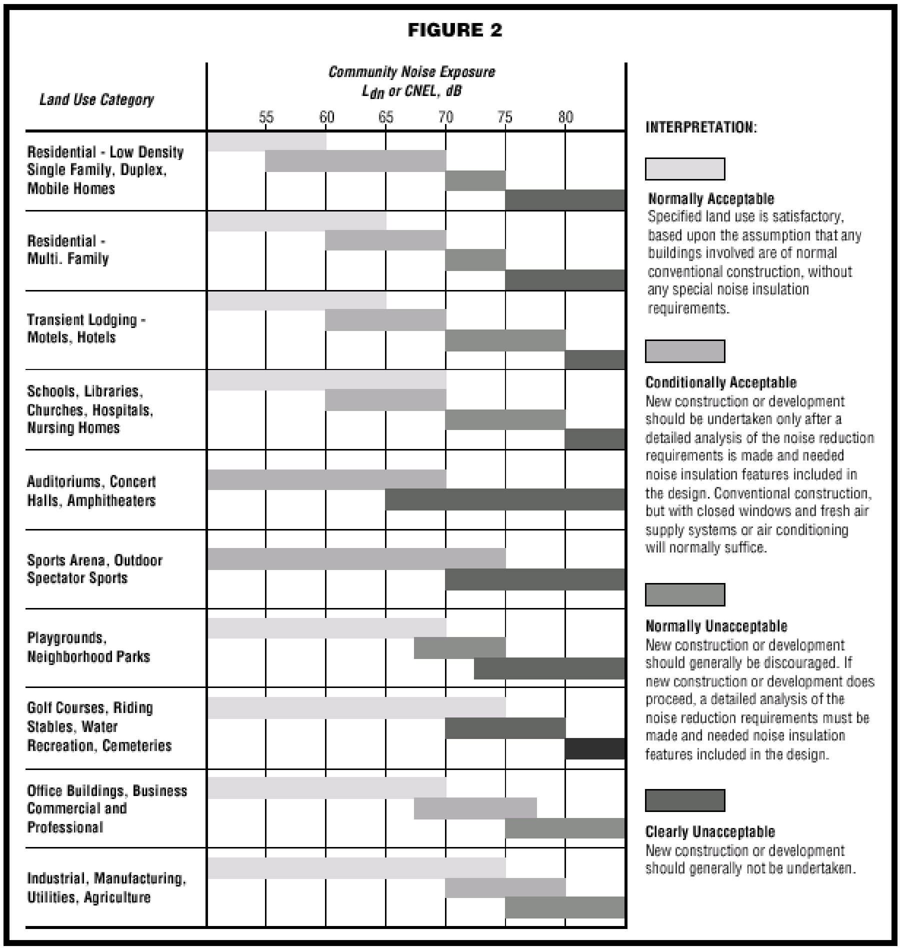
B. TITLE 21, CHAPTER 2.5, SUBCHAPTER 6, CALIFORNIA CODE OF REGULATIONS

The Caltrans Division of Aeronautics defines a 65 dBA CNEL noise criterion as part of its "Noise Standards" with respect to aviation traffic as measured at potentially impacted residences near an airport. Quarterly reports of measured noise levels near an airport (prepared and submitted to determine where these requirements are satisfied) can offer insight about the surrounding ambient acoustical environment, which may help describe and/or model current existing noise levels as part of HST noise impact assessment.

C. TITLE 24, PART 2, CALIFORNIA CODE OF REGULATIONS

The California Noise Insulation Standard (California Administrative Code, [Code] Part 2, Title 24, Appendix Chapter 35, Section 3501) limits interior noise exposure levels within multi-family (not single-family detached houses) residential developments to 45 dB CNEL or 45 dB L_{dn}.

Often adopted by city and county agencies for land use planning purposes, the State of California Department of Health Land Use Compatibility Criteria features guidelines for acoustical compatibility based on existing ambient noise levels in the community. For example, commercial land uses are considered appropriate where existing noise levels might be considered too high for residential development. These criteria, expressed as ranges, are presented on Figure 3-5.



Source: Governor's Office of Planning and Research 2003

Figure 3-5
State of California land use compatibility guidelines

D. CALTRANS TRAFFIC NOISE ANALYSIS PROTOCOL

The Caltrans Technical Noise Supplement (Caltrans 2009) establishes guidelines for construction of noise barriers along highways where sensitive receivers are located. It specifies parameters such as barrier dimensions, locations, type of barriers, and standard aesthetic treatments. Under FHWA and Caltrans policies, noise barriers should be considered for transportation improvement projects when the following criteria are met:

1. Predicted worst-case hourly noise level is expected to approach or exceed the FHWA NAC (e.g., 67 dBA L_{eq} for residences or other Category B land uses) or increase ambient noise levels substantially. Caltrans considers an increase of 12 dBA to be substantial. Under current Caltrans policy, a noise level of 66 dBA is considered to be approaching the NAC of 67 dBA.

2. A feasible noise barrier must provide a minimum noise reduction of 5 dBA to achieve a noticeable change in noise level.

3. A reasonable noise barrier must be cost-effective and should take into consideration the number of residences that would benefit from the barrier(s). In addition to cost of abatement and noise-related factors such as absolute noise levels and change in noise levels, many other factors are considered. These factors include: date of development along the highway, impacts of noise abatement on other resources, opinions of impacted residents, safety, social, economic, environmental, legal, and technological factors.

4. The noise barrier must interrupt the lone-of-sight between the noise source (traffic on the roadway) and the receiver [assumed to be 4.9 feet high].

Caltrans (Traffic Noise Analysis Protocol) and FHWA (23 CFR 772) policies address the timing and applicability of noise abasement measures as part of the roadway project. Noise abatement at noise-sensitive land uses must be considered as part of the project (when NAC are approached or exceeded) if noise-sensitive development was planned, designed, and programmed prior to the roadway project's date of public knowledge. A development is considered planned, designed, and programmed on the date that final approval is granted from the local jurisdiction (for example, issuance of building permits from a city planning agency). The date of public knowledge of the roadway project is the date of approval of the final environmental decision document (for example, the ROD).

3.2.3 Regional

A summary of the significant local noise criteria for each of the jurisdictions described in the following section is found in Appendix B

3.2.4 County

A. COUNTY OF FRESNO

The County of Fresno's Noise Element (Fresno County 2000) separates residential land uses into two distinct categories that consist of rural residential and urban residential land uses. Each land use has unique maximum acceptable noise. Table 3-7 lists the maximum acceptable noise levels for noise-sensitive land uses. This table can be found in the Fresno County Noise Element. Areas are recognized as impacted if the existing or projected future noise levels at the noise-sensitive land uses exceed the levels found in Table 3-7. Maximum acceptable exterior and interior L_{dn} values for rural and urban residential and noise-sensitive receivers are listed in Table 3-7. The L_{50} values found in Table 3-7 are the maximum acceptable noise levels from noise sources at rural residential, urban residential and noise-sensitive, urban commercial and urban industrial land uses.

Tables 3-8 and 3-9 come from the Fresno County Noise Ordinance. The Fresno County Noise Ordinance does not differentiate between rural and urban areas. The noise standards found in Tables 3-8 and 3-9 apply to all residences, schools, hospitals, churches, and public libraries. Table 3-9 lists the exterior noise standards by time of exposure within a one-hour time period. A 50 dBA L_{50} is the daytime baseline criterion noise level and a 45 dBA L_{50} is the nighttime baseline noise criterion. Table 3-10 displays the interior noise standards for all residential land uses. The daytime interior noise standard for residences is an $L_{8.3}$ of 45 dBA and the nighttime interior noise standard for residences is an $L_{8.3}$ of 35 dBA. Impulsive or pure tone noise is penalized by a reduction of 5 dBA for each noise standard.

Table 3-7
Fresno County Existing Noise Element:
Maximum Acceptable Noise Levels (dBA)

Land Use	L_{50}		L_{dn}	
	Daytime	**Nighttime**	**Exterior**	**Interior**
Rural residential	50	45	55	45
Urban residential and noise-sensitive receivers[1]	55	50	60	45
Urban commercial	65	60		
Urban industrial	70	70		

Notes:
1 Schools, parks, hospitals, and rest homes.
dBA = A-weighted decibels
Ldn = day-night sound level, dBA
Source: Fresno County 2000.

Table 3-8
Fresno County Noise Control Ordinance: Exterior Noise Standards (dBA)

Cumulative Number of Minutes in Any 1-Hour Period	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
30	50	45
15	55	50
5	60	55
1	65	60
0	70	65

dBA = A-weighted decibels
Source: Fresno County Noise Ordinance, 1978.

Table 3-9
Fresno County Noise Control Ordinance: Interior Noise Standards (dBA)

Cumulative Number of Minutes in Any 1-Hour Period	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
5	45	35
1	50	40
0	55	45

dBA = A-weighted decibels
Source: Fresno County1978.

Table 3-10
Kings County Noise Standards for New Uses Affected by Transportation Noise Sources

Table N-7 Noise Standards for New Uses Affected by Transportation Noise Sources

New Land Use	Sensitive[1] Outdoor Area - CNEL	Sensitive Interior[2] Area - CNEL	Notes
Residential	60	45	5
Residences in Ag. Zones	65	45	6
Transient Lodging	65	45	3,5
Hospitals & Nursing Homes	60	45	3, 4, 5
Theaters & Auditoriums	---	35	3
Churches, Meeting Halls	60	40	3
Schools, Libraries, etc.	60	40	3
Office Buildings	65	45	3
Commercial Buildings	65	50	3
Playgrounds, Parks, etc.	70	---	
Industry	65	50	3

Notes:
1. Sensitive areas are defined acoustic terminology section.
2. Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
3. Where there are no sensitive exterior spaces proposed for these uses, only the interior noise level standard shall apply.
4. Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
5. If this use is affected by railroad or aircraft noise, a maximum (Lmax) noise level standard of 70 dB shall be applied to all sleeping rooms with windows closed to reduce the potential for sleep disturbance during nighttime noise events.
6. Due to the noise-generating nature of agricultural activities, it is understood that residences constructed on agriculturally-designated land uses may be exposed to elevated noise levels. As a result, a 65 dB CNEL exterior noise level standard is applied to noise-sensitive outdoor areas of these uses.

Source: Kings County 2010.

In the County of Fresno, construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 7:00 a.m. to 5:00 p.m.

B. COUNTY OF KINGS

The County of Kings Noise Element lists six major noise sources that were considered in preparation of the noise element. These include:

- Highways and freeways
- Primary arterial and major local streets
- Railroad and ground rapid transit systems
- Aircraft and airport operations
- Local industrial facilities (including railroad classification yards)
- Other stationary sources

Table N-7 from the Kings County Noise Element is shown in Table 3-10. The table lists the noise standards for various land uses affected by transportation noise sources. Exterior and interior CNEL values are listed along with applicable notes for each specific land use. At residences in non-agricultural land use areas, the exterior noise standard for transportation noise sources in Kings County is 60 dBA CNEL. This is the most stringent standard for transportation noise sources.

Table N-8 from the Kings County Noise Element is shown in Table 3-11. The table lists the noise standards for various land uses affected by non-transportation noise sources. Exterior and interior L_{eq} and L_{max} values are listed along with notes for each specific land use. Only residential land uses have an exterior nighttime standard. The daytime and nighttime exterior noise standards at residential land uses caused by non-transportation noise sources are 55 dBA L_{eq} and 50 dBA L_{eq}, respectively. Impulsive noise and sounds consisting primarily of speech or music are penalized by a reduction of 5 dBA for each noise standard and correlating land use.

N Policy B1.2.1 of the Kings County Noise Element establishes levels of significant increase in noise due to the introduction of new transportation projects. This policy includes new rail projects. If the significance thresholds in Table 3-12 are exceeded, then mitigation is required. For example, if the ambient noise level at a noise-sensitive land use is between 60- 65 dB L_{dn} and the projected increase in the L_{dn} is more than 3 dB, there is a significant noise impact.

Table 3-11
Kings County Noise Standards for Non-Transportation Noise Sources

Table N-8 Non-Transportation Noise Standards
Average (Leq) / Maximum (Lmax)[1]

Receiving Land Use	Outdoor Area[2] Daytime	Outdoor Area[2] Nighttime	Interior[3] Day & Night	Notes
All Residential	55 / 75	50 / 70	35 / 55	
Transient Lodging	55 / 75	---	35 / 55	4
Hospitals & Nursing Homes	55 / 75	---	35 / 55	5, 6
Theaters & Auditoriums	---	---	30 / 50	6
Churches, Meeting Halls, Schools, Libraries, etc.	55 / 75	---	35 / 60	6
Office Buildings	60 / 75	---	45 / 65	6
Commercial Buildings	55 / 75	---	45 / 65	6
Playgrounds, Parks, etc.	65 / 75	---	---	6
Industry	60 / 80	---	50 / 70	6

Notes:
1. The Table N-8 standards shall be reduced by 5 dB for sounds consisting primarily of speech or music, and for recurring impulsive sounds. If the existing ambient noise level exceeds the standards of Table N-8, then the noise level standards shall be increased at 5 dB increments to encompass the ambient.
2. Sensitive areas are defined acoustic terminology section.
3. Interior noise level standards are applied within noise-sensitive areas of the various land uses, with windows and doors in the closed positions.
4. Outdoor activity areas of transient lodging facilities are not commonly used during nighttime hours.
5. Hospitals are often noise-generating uses. The exterior noise level standards for hospitals are applicable only at clearly identified areas designated for outdoor relaxation by either hospital staff or patients.
6. The outdoor activity areas of these uses (if any), are not typically utilized during nighttime hours.

Source: Kings County 2010.

Table 3-12
Kings County: Significant Increases in Noise Levels Due to New Roadway and Rail Projects

Pre-Project Noise Environment (L_{dn})	Significant Increase
Less than 60 dB	5+ dB
60–65 dB	3+ dB
Greater than 65 dB	1.5+ dB

dB = decibels
L_{dn} = day-night sound level, dBA
Source: Kings County 2010

In the County of Kings, construction noise is exempt from local noise standards from 7:00 a.m. to 7:00 p.m. on weekdays and from 9:00 a.m. to 6:00 p.m. on Saturday and Sunday.

C. COUNTY OF TULARE

The County of Tulare's Noise Element uses the State of California's Land Use Compatibility Guidelines. Figure 3-5 summarizes the acceptable exterior noise criteria for various land uses under these guidelines. The exterior noise level criterion is 60 dBA CNEL at single-family homes and 65 dBA CNEL at multi-family residential land uses. These are the most stringent allowable noise levels among the land uses.

Table 3-13 and Table 3-14 summarize the County of Tulare's noise standards for noise-sensitive land uses. Noise-sensitive land uses include residences and other institutional land uses such as schools, hospitals, parks and recreations areas, and churches. Table 3-14 lists the exterior noise standards by time of exposure within a one-hour time period. A 50 dBA L_{50} is the daytime baseline criterion noise level and a 45 dBA L_{50} is the nighttime baseline noise criterion. Table 3-14 displays the interior noise standards for all residential land uses. The daytime interior noise standard for residences is an $L_{8.3}$ of 45 dBA and the nighttime interior noise standard for residences is an $L_{8.3}$ of 35 dBA. Impulsive, or pure tone, noise is penalized by a reduction of 5 dBA for each noise standard.

Table 3-13
Tulare County Exterior Noise Standards (dBA): Non-Transportation Noise Sources

Cumulative Number of Minutes in Any 1-Hour Period	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
30	50	45
15	55	50
5	60	55
1	65	60
0	70	65

dBA = A-weighted decibels
Source: Tulare County 2010

Table 3-14
Tulare County Residential Interior Noise Standards (dBA): Non-Transportation Noise Sources

Cumulative Number of Minutes in Any 1-Hour Period	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
5	45	35
1	50	40
0	55	45

dBA = A-weighted decibels
Source: County of Tulare 2010.

In the County of Tulare, construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m.

D. COUNTY OF KERN

The County of Kern Noise Element lists six major noise sources that were considered in preparation of the noise element. These include:

- Highways and freeways
- Primary arterial and major local streets
- Railroad operations
- Aircraft and airport operations
- Local industrial facilities
- Other stationary sources

The County of Kern Noise Element states noise-sensitive land uses include residences and other institutional land uses such as schools, hospitals, parks and recreations areas, and churches. Noise-sensitive land uses should be discouraged in noise impacted areas unless proper mitigation can reduce exterior levels to 65 dBA L_{dn} or reduce interior noise levels to 45 dBA L_{dn} within living spaces. Significant noise impact criteria for Kern County are summarized above in Appendix B.

Construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m.

3.2.5 Cities

A. CITY OF FRESNO

The City of Fresno Noise Element identifies transportation corridors and industrial uses as major noise source contributors that helped in the preparation of the noise element. Table 3-15 comes from the City of Fresno's General Plan Noise Element. The interior and exterior maximum allowable noise exposure levels from transportation noise sources at noise-sensitive land uses are listed in the table. The noise element states, "New noise-sensitive land uses impacted by existing or projected future transportation noise sources shall include mitigation measures so that resulting noise levels do not exceed the standards shown in [Table 3-15]." The most stringent maximum allowable exterior noise level is 60 dB L_{dn} at residential and several other land uses listed in Table 3-16.

Table 3-15
City of Fresno Maximum Allowable Noise Exposure: Transportation Noise Sources

Land Use [4]	Outdoor Activity Areas[1] L_{dn} dB	Interior Spaces	
		L_{dn} dB	L_{eq} dB[2]
Residential	60[3]	45	---
Transient Lodging	60[3]	45	---
Hospitals, Nursing Homes	60[3]	45	---
Theaters, Auditoriums, Music Halls	---	---	35
Churches, Meeting Halls	60[3]	---	45
Office Buildings	---	---	45
Schools, Libraries, Museums	---	---	45

[1]Where the location of outdoor activity areas is unknown or is not applicable, the exterior noise level standard shall be applied to the property line of the receiving land use.

[2]As determined for a typical worst-case hour during periods of use.

[3]Noise levels up to 65 dB L_{dn} adjacent to the Burlington Northern Santa Fe and Union Pacific mainline tracks may be allowed by the project approving authority when it is determined that it is not possible to achieve 60 dB L_{dn} in outdoor activity areas using a practical application of the best-available noise reduction technology, and when all feasible exterior noise reduction measures have been proposed.

[4] The Planning and Development Director, on a case-by-case basis, may designate land uses other than those shown in this table to be noise-sensitive, and may require appropriate noise mitigation measures.

Source: City of Fresno 2002.

The City of Fresno Noise Element also establishes exterior daytime and nighttime maximum allowable noise exposure levels at noise-sensitive land uses. The noise element states, "New noise-sensitive land uses impacted by stationary noise sources shall include mitigation measures so that resulting noise levels do not exceed the standards shown in [Table 3-16]."

Table 3-16
City of Fresno Maximum Allowable Noise Exposure: Stationary Noise Sources

Noise Level*	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Hourly L_{eq}, dB	50	45
Maximum level, dB	70	65

[a] As determined in outdoor activity areas. Where the location of an outdoor activity area is unknown, the noise standard shall be applied at the property line of the receiving land use. When ambient levels exceed or equal the levels in the table, mitigation shall only be required to limit noise to the ambient plus 5 dB.

dB = decibels
L_{eq} = equivalent sound level, dBA
Source: City of Fresno 2002.

The City of Fresno Noise Ordinance also establishes exterior noise level standards based on L_{25} values at residential, commercial and industrial land uses. L_{25} values are based on the noise level averaged over a period of 15 minutes. Exterior noise level standards for residential land uses are unique for the City of Fresno. Residential noise standards are separated into three distinct time periods. The L_{25} values for daytime, evening, and nighttime noise standards at residential land uses can be found in Table 3-17. Exterior noise standards for commercial land uses are separated by two distinct periods: daytime and nighttime. Industrial land use noise standards apply to any part of the day.

Table 3-17
City of Fresno: Exterior Noise Level Standards

District	Time	L_{25} (dB)
Residential	10 p.m. to 7 a.m.	50
Residential	7 p.m. to 10 p.m.	55
Residential	7 a.m. to 7 p.m.	60
Commercial	10 p.m. to 7 a.m.	60
Commercial	7 a.m. to 10 p.m.	65
Industrial	anytime	70

dB = decibels
Source: City of Fresno 2002.

H-1-b. Policy of the City of Fresno Noise Element establishes levels of significant increase in noise due to new projects. This policy includes new rail projects. If the significance thresholds in Table 3-18 are exceeded, then mitigation will be required. For example, if the ambient noise level at a noise-sensitive land use is between 60 and 65 dB L_{dn} and the projected increase in the L_{dn} is more than 3 dB, there is a significant noise impact.

Table 3-18
City of Fresno: Significant Increases in Noise Levels
due to New Roadway and Rail Projects

Pre-Project Noise Environment (L_{dn})	Significant Increase
Less than 60 dB	5+ dB
60–65 dB	3+ dB
Greater than 65 dB	1.5+ dB

dB = decibels
L_{dn} = day-night sound level, dBA
Source: City of Fresno 2002.

According to the City of Fresno Noise Ordinance, construction noise is exempt from local standards from 7:00 a.m. to 10:00 p.m. Monday through Saturday and it is not exempt on Sunday.

B. CITY OF HANFORD

The City of Hanford Noise Element identifies local highways and railroads as the major noise contributors that were taken into account in preparation of the noise element. Table 3-19 lists noise-sensitive land uses and each respective exterior and interior maximum allowable noise exposure level. The noise element states, "The compatibility of proposed projects with existing and future noise levels due to ground transportation noise sources shall be evaluated in relation to [Table 3-19]. Noise levels in outdoor activity areas and interior spaces shall be mitigated to the levels shown in [Table 3-19]."

Table 3-19
City of Hanford Maximum Allowable Noise Exposure to Ground Transportation Noise Sources

Land Use	Outdoor Activity Areas[a]	Interior Spaces	
	L_{dn}/CNEL, dB	L_{dn}/CNEL, dB	L_{eq}, dB[b]
Residential	60[c]	45	-
Transient lodging	60[c]	45	-
Hospitals, nursing homes	60[c]	45	-
Theaters, auditoriums, music halls	-	-	35
Churches, meeting halls	60[c]	-	40
Office buildings	-	-	45
Schools, libraries, museums	-	-	45
Playgrounds, neighborhood parks	70	-	-

Notes:
[a] Where the location of outdoor activity areas is unknown, the exterior noise-level standard shall be applied to the property line of the receiving land use.

[b] As determined for a typical worst case hour during periods of use.

[c] Where it is not possible to reduce noise in outdoor activity areas to 60 dB Ldn /CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB Ldn /CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

CNEL = Community Noise Equivalent Level, dBA
dB = decibels
L_{dn} = day-night sound level, dBA
L_{eq} = equivalent sound level, dBA

Source: City of Hanford 2002.

The City of Hanford Noise Element also establishes a set of noise standards for new projects affected by or including non-transportation sources. Daytime and nighttime noise standards for exterior and interior noise-sensitive land uses are listed in Table 3-20. The L_{eq} values found in the noise standards are based on hourly L_{eq} levels. The City of Hanford Noise Element states, "Noise created by non-transportation noise sources shall be mitigated so as not to exceed the interior and exterior noise level standards found in Table 3-20. New development of noise-sensitive land uses shall not be allowed where noise level due to non-transportation noise sources will exceed the standards in Table 3-20."

In a phone conversation on March 24, 2010, Mr. Jim Kochar, Hanford's chief building official, stated that typical construction noise exempt times for the City of Hanford are all days of the week from 7:00 a.m. to 5:00 p.m. (Kochar 2010, personal communication).

Table 3-20
City of Hanford Noise-Level Performance Standards for New Projects Affected by or Including Non-Transportation Sources

Land Use	Noise-Level Descriptor	Exterior Noise-Level Standard (Applicable at Property Line)		Interior Noise-Level Standard	
		Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Residential	L_{eq} L_{max}	50 70	45 65	40 60	35 55
Transient lodging, hospitals, nursing homes	L_{eq} L_{max}	- -	- -	40 60	35 55
Theaters, auditoriums, music halls	L_{eq}	-	-	35	35
Churches, meeting halls	L_{eq}	-	-	40	40
Office buildings	L_{eq}	-	-	45	-
Schools, libraries, museums	L_{eq}	-	-	45	-
Playgrounds, parks	L_{eq}	65	-	-	-

Notes:
Each of the noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting of speech or music, or recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

L_{eq} = equivalent sound level, dBA
L_{max} = maximum sound level, dBA

Source: City of Hanford 2002.

C. CITY OF CORCORAN

The City of Corcoran's Noise Element lists six major noise sources that were considered in preparation of the noise element. These include:

- Highways and freeways.
- Primary arterials and major local streets.
- Passenger and freight on-line railroad operations and ground rapid transit systems.

- Commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and all other ground facilities and maintenance functions related to airport operation.
- Local industrial plants, including, but not limited to, railroad classification yards.
- Other ground stationary noise sources identified by local agencies as contributing to the community noise environment.

The City of Corcoran's Noise Element states that "noise-sensitive land uses include residences, hospitals, schools, churches, and other uses of a similar nature as determined by the Planning Director." Areas are recognized as impacted if the existing or projected future noise levels at the exterior of noise-sensitive land uses exceed 65 dBA CNEL. Noise-sensitive land uses should be discouraged in noise impacted areas unless proper mitigation can reduce exterior levels to 65 dBA CNEL or reduce interior noise levels to 45 dBA CNEL within living spaces (City of Corcoran 2007).

Construction noise is exempt from local standards every day from 6:00 a.m. to 7:00 p.m.

D. CITY OF DELANO

The City of Delano Noise Element establishes exterior and interior noise level standards to protect noise-sensitive land uses from noises generated by transportation noise sources. These include noise from roadways, railroad line operations, and aircraft in flight. Table 3-21 summarizes the exterior and interior noise level standards for transportation noise sources, as found within the noise element. Table 3-22 summarizes the daytime and nighttime noise level standards for stationary noise sources.

Table 3-21
City of Delano Exterior Noise Level Standards – Transportation Sources

Land Use	Outdoor Activity Areas L_{dn}/CNEL, dB	Interior Spaces L_{dn}/CNEL, dB
Residential (except temporary dwellings	65[1]	45
Hotels and Motels	65[1]	45
Hospital, Nursing and Personal Care	65[1]	45
Churches, Meeting Halls	- -	45
Schools-Preschool to Secondary, College and University, Specialized Education and Training, Libraries and Museums	- -	45

[1] Where the location of the outdoor activity areas is unknown, the exterior noise level standard shall be applied to the boundary of planned or zoned noise-sensitive uses.

Source: City of Delano 2005

Table 3-22
City of Delano Exterior Noise Level Standards – Stationary Sources[1]

	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Hourly L_{eq}, dB	55	50
Maximum Level, dB	75	70

[1] As determined in outdoor activity areas. Where the location of the outdoor activity areas is unknown, the exterior noise level standard shall be applied to the boundary of planned or zoned noise-sensitive uses.
Source: City of Delano 2005

The City of Delano also establishes exterior noise level standards in the City of Delano Noise Ordinance. Table 3-23 can be found in the City of Delano Noise Ordinance, and it expands on the levels and zones found in Table 3-22. Commercial, manufacturing, and heavy industry/airport district zoning exterior noise levels can be found in Table 3-23.

Table 3-23
City of Delano Exterior Noise Level Standards

Zone	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
R-1, R-2 and Other Residential	55	50
Commercial	60	55
Manufacturing	65	60
Heavy Industry and Airport District	75	65

Source: City of Delano Noise Ordinance, City of Delano, 1986).

The City of Delano establishes construction noise standards by stating, "It is unlawful for any person within a residential zone, or within a radius of 300 feet therefrom, to operate equipment or perform any outside construction or report work on buildings, structures or projects or to operate any pile driver, steam shovel, pneumatic hammer, derrick, steam or electric hoist, or other construction type device in such a manner that noise is produced which would constitute a violation of Section 9.36.040, unless beforehand a permit therefor has been duly obtained from the building division. No permit shall be required to perform emergency work as defined in Article I of this chapter." (City of Delano Noise Ordinance, City of Delano, 1986). A permit should be obtained from the City of Delano's building division before construction begins near the vicinity of the City of Delano.

E. CITY OF WASCO

The City of Wasco Noise Element lists the following as noise-sensitive land uses:

- Residential
- Schools
- Hospitals, nursing and personal care
- Churches
- Other uses of a similar nature as determined by the Planning Director

The City of Wasco Noise Element states, "Areas shall be recognized as noise impacted if exposed to existing or projected future noise levels at the exterior of building which exceed 65 dB L_{dn} (or CNEL). Noise-sensitive land uses should be discouraged in noise impacted areas unless effective mitigation measures are incorporated into the specific design of such projects to reduce exterior noise levels to 65 dB L_{dn} (or CNEL) or less and 45 dB L_{dn} (or CNEL) or less within interior living spaces."

In a phone conversation on March 4, 2010, Ms. Duviet Rodriguez (Executive Assistant to the City Manager, City of Wasco) stated that typical construction noise exempt times for the City of Wasco are from 7:00 a.m. to 7:00 p.m. on weekdays and from 9:00 a.m. to 6:00 p.m. on Saturdays and Sundays (Rodriguez 2010, personal communication).

F. CITY OF SHAFTER

The City of Shafter Noise Element establishes exterior noise levels that need to be achieved and maintained throughout the City of Shafter at noise-sensitive land uses as well as at commercial and industrial land uses. Table 3-24 summarizes the exterior noise level standards found in the noise element.

Table 3-24
City of Shafter Exterior Noise Level Standards

Land Use	Exterior Noise Level Standard (dBA CNEL)
Residential[1]	60–65
School classrooms	60
Play and sports areas	70
Hospital, libraries	60
Commercial/industrial[2]	65–70

Notes:

[1] Single-family residential land use: 60–65 dBA CNEL within rear yards; multifamily residential land use: 60–65 dBA CNEL within interior open spaces.

[2] Commercial and industrial land use noise levels measured at the front setback.

CNEL = Community Noise Equivalent Level, dBA
dBA = A-weighted decibels

Source: City of Shafter 2005.

For construction noise, according to the City of Shafter Noise Ordinance, "within a residential zone, or within a radius of 500 feet therefrom, no person shall operate equipment, for the construction or repair of buildings, structures or projects, which creates noise exceeding the ambient noise level beyond 50 feet from the source between the hours of 7:00 p.m. and 7:00 a.m."

G. METROPOLITAN BAKERSFIELD AND CITY OF BAKERSFIELD

Metropolitan Bakersfield is comprised of the City of Bakersfield and the surrounding areas. Metropolitan Bakersfield lists six major noise sources that were considered in preparation of the Metropolitan Bakersfield Noise Element (City of Bakersfield and County of Kern 2002). These include:

- Highways and freeways
- Primary arterial and major local streets
- Railroad operations
- Aircraft and airport operations
- Local industrial facilities
- Other stationary sources

The Metropolitan Bakersfield Noise Element lists residential areas, schools, convalescent and acute care hospitals, and parks and recreation areas as noise-sensitive land uses. The Metropolitan Bakersfield Noise Element uses the State of California's Land Use Compatibility Guidelines for the area. Figure 3-5 summarizes the maximum allowable noise levels at various land uses that Metropolitan Bakersfield uses. The maximum allowable noise level for noise sources is 60 dBA CNEL at single-family homes and 65 dBA CNEL at multi-family residential land uses. These are the most stringent allowable noise levels among the land uses.

Table 3-25 comes from the Metropolitan Bakersfield Noise Element. Table 3-25 lists the exterior noise level standards for the City of Bakersfield and the surrounding areas within Metropolitan Bakersfield for non-transportation noise sources. The noise standards apply to the exterior of all noise-sensitive land uses. Table 3-25 lists the exterior noise standards by time of exposure within a one-hour time period. A 55 dBA L_{50} is the daytime baseline criterion noise level and a 50 dBA L_{50} is the nighttime baseline noise criterion. Impulsive, or pure tone, noise is penalized by a reduction of 5 dBA for each noise standard. There are no interior noise level standards in the City of Bakersfield Noise Ordinance or the Metropolitan Bakersfield General Plan Noise Element.

Table 3-25
Metropolitan Bakersfield Noise Element: Exterior Noise Level Standards

Cumulative Number of Minutes in Any 1-Hour Period	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
30	55	50
15	60	55
5	65	60
1	70	65
0	75	70
Source: City of Bakersfield 2002.		

The Metropolitan Bakersfield Noise Element establishes noise standards for cumulative impacts relating to the introduction of new projects in the area. The noise element states:

"A significant increase in ambient noise level affecting existing noise-sensitive land uses (receptors), requiring the adoption of practical and feasible mitigation measures, is deemed to occur where a project will cause:

An increase in ambient noise level of 1 dB or more over 65 dB CNEL, where the existing ambient level is 65 dB CNEL or less;

or

The ambient noise level is less than 60 dB CNEL and the project increases noise levels by 5 dB or more;

The ambient noise level is 60 to 65 dB CNEL and the project increases noise levels by 3 dB or more;

The ambient noise level is greater than 65 dB CNEL and the project increases noise levels by 1.5 dB or more."

According to the City of Bakersfield's Noise Ordinance, construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m. There are no construction noise exempt times in the Metropolitan Bakersfield Noise Element.

3.3 Vibration Laws, Regulations, and Orders

3.3.1 Federal

Vibratory motion of the ground at a specific location, caused by the passage of high speed trains, may result in two forms of human annoyance that are discussed above under FTA and FRA guidelines (Sections 4.1.3 and 4.1.4). Ground-borne vibration is tactile movement of the ground and/or structures, whereas ground-borne noise is the radiation of acoustical energy from ground and structural surfaces excited by ground-borne vibration. Broadly speaking, vibration impact criteria levels are influenced by land-use category and vibration event frequency (i.e., how often does a train passage occur within a given time period?).

As with train passage events, construction activity can also be considered on the basis of vibration occurrence frequency, so the same vibration criteria (in the absence of standardized construction vibration compliance criteria) could be used to help determine vibration impacts during project construction.

A. FRA GUIDELINES

The FRA guidelines (FRA 2005), which acknowledge the FTA guidance document (FTA 2006) as their basis, provide ground-borne noise and vibration criteria as shown in Table 3-26. These levels represent the maximum RMS level of an event. In addition, the guidelines provide criteria for special buildings that are very sensitive to ground-borne noise and vibration. The impact criteria for these special buildings are shown in Table 3-27.

Both Tables 3-26 and 3-27 differentiate vibration impact threshold depending on the number of vibration events per day, with fewer than 70 vibration events per day considered "infrequent" and more than 70 events as "frequent." This dividing line was originally selected so that most commuter rail or intercity rail projects would fall into the "infrequent" category and most urban transit projects (subway and light rail transit) would more typically be in the "frequent" category. However, given the current heavy use of the existing rail line in some of the more urban areas of the project corridor (with total existing usage approaching 50 trains per day), it is possible that the addition of the proposed HST system could push into the "frequent" category in some areas.

Table 3-26
Ground-Borne Vibration and Noise Impact Criteria for Affected Communities

Land Use Category		Ground-Borne Vibration Impact Levels (VdB re 1 micro inch/sec)		Ground-Borne Noise Impact Levels (dB re 20 micropascals)	
		Frequent Events[a]	Infrequent Events[b]	Frequent Events[a]	Infrequent Events[b]
Category 1:	Buildings where vibration would interfere with interior operations	65 VdB[c]	65 VdB[c]	N/A[d]	N/A[d]
Category 2:	Residences and buildings where people normally sleep	72 VdB	80 VdB	35 dBA	43 dBA
Category 3:	Institutional land uses with primarily daytime use	75 VdB	83 VdB	40 dBA	48 dBA

Notes:
[a] Frequent events are defined as more than 70 vibration events per day.
[b] Infrequent events are defined as fewer than 70 vibration events per day.
[c] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research requires detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating, ventilation, and air-conditioning systems and stiffened floors.
[d] Vibration-sensitive equipment is not sensitive to ground-borne noise.
dB = decibels
dBA = A-weighted decibels
N/A = not applicable
VdB = RMS vibration velocity level
Source: FRA 2005.

Table 3-27
Ground-Borne Vibration and Noise Impact Criteria for Special Buildings

Type of Building or Room	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch/sec)		Ground-Borne Noise Impact Levels (dB re 20 micropascals)	
	Frequent Events[a]	Infrequent Events[b]	Frequent Events[a]	Infrequent Events[b]
Concert halls	65 VdB	65 VdB	25 dBA	25 dBA
Television studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Notes:
1. Frequent events are defined as more than 70 vibration events per day.
2. Infrequent events are defined as fewer than 70 vibration events per day.
dB = decibels
dBA = A-weighted decibels
sec = second(s)
VdB = RMS vibration velocity level, dB
Source: FRA 2005.

B. EXISTING VIBRATION CONDITIONS

One factor not incorporated in the criteria is how to account for existing vibration. In most cases, except near railroad tracks, the existing environment does not include a significant number of perceptible ground-borne vibration or noise events. However, it is common for high-speed train projects to use parts of existing rail corridors. The criteria given in Tables 7-1 and 7-2 do not indicate how to account for existing vibration, a common situation for high-speed rail projects using existing rail right-of-ways. Methods of handling representative scenarios include the following:

1. *Infrequently used rail corridor* : Use the vibration criteria from Tables 7-1 and 7-2 when the existing rail traffic consists of four or less trains per day.

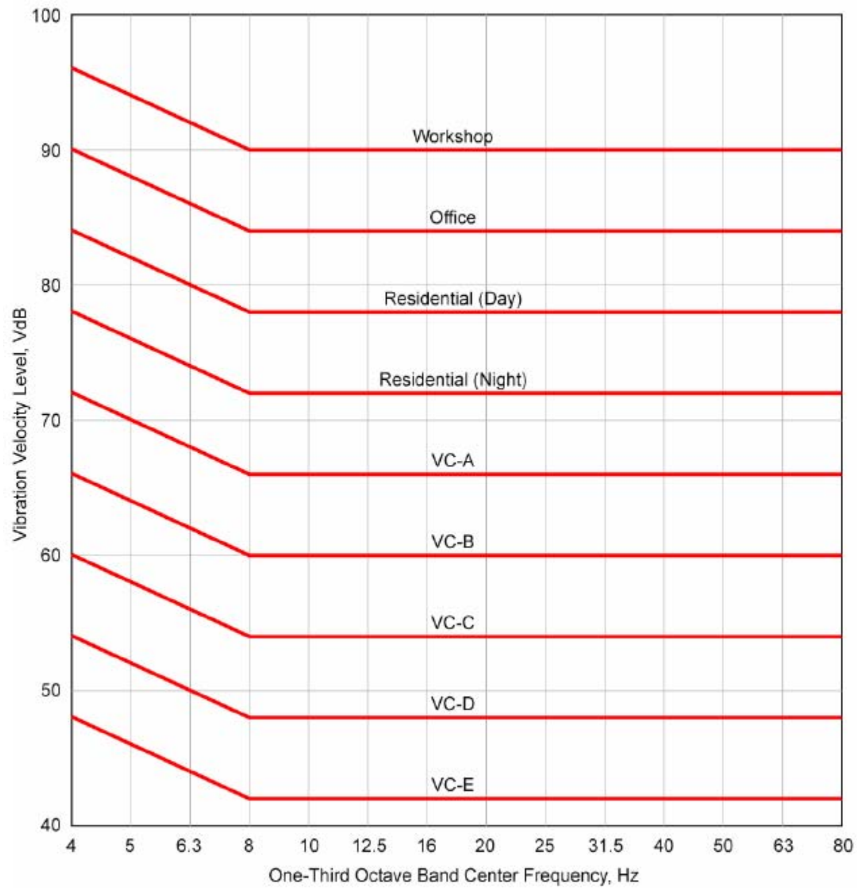
2. *Moderately used rail corridor* : If the existing traffic consists of 5 to 12 trains per day with vibration that substantially exceeds the impact criteria, there is no impact as long as the project vibration levels estimated using the procedures outlined in either Chapter 8 or 9 are at least 5 VdB less than the existing vibration. Vibration from existing trains could be estimated using the General Assessment procedures in Chapter 8; however, it is usually preferable to measure vibration from existing train traffic.

3. *Heavily used rail corridor* : If the existing traffic exceeds 12 trains per day and if the project will not significantly increase the number of vibration events (less than doubling the number of trains is usually considered not significant), there will not be additional impact unless the project vibration, estimated using the procedures of Chapters 8 or 9, will be higher than the existing vibration. In locations where the new trains will be operating at much higher speeds than the existing rail traffic, it is likely that the high-speed trains will generate substantially higher levels of ground-borne vibration. When the project will cause vibration more than 5 VdB greater than the existing source, the existing source can be ignored and the vibration criteria in Tables 7-1 and 7-2 applied to the project.

4. *Moving existing tracks*: Another scenario where existing vibration can be significant is a new high speed rail line within an existing rail right-of-way that will require shifting the location of existing tracks. Where the track relocation will cause higher vibration levels at sensitive receptors, then the projected vibration levels from both rail systems must be compared to the appropriate impact criterion to determine if there will be new impact. If impact is judged to have existed prior to moving the tracks, new impact will be assessed only if the relocation results in more than 3 VdB increase in vibration level. Although the impact thresholds given in Tables 7-1 and 7-2 are based on experience with vibration from rail transit systems, they can be applied to freight train vibrations as well. However, locomotive and rail car vibration should be considered separately. Because the locomotive vibration only lasts for a few seconds, the infrequent event limit is appropriate, but for a typical line haul freight train where the rail car vibration lasts for several minutes, the frequent-event limits should be applied to the rail car vibration. Some judgment must be exercised to make sure that the approach is reasonable. For example, some spur rail lines carry very little rail traffic (sometimes only one train per week) or have short trains, in which case the infrequent limits are appropriate.

C. FTA GUIDELINES

The FTA guidance document expands the discussion of vibration impact to include criteria, as shown on Figure 3-6, where international standard curves and industry standards are superimposed and compared with plots of one-third octave band vibration level spectra as part of a detailed analysis. Revealed exceedances, and their magnitudes, from this comparison indicate where mitigation would be needed and over what range of frequencies treatment would have to be effective. Table 3-28 shows an interpretation of these vibration criteria.



Source: FTA 2006

Figure 3-6
Criteria for detailed vibration analysis

Table 3-28
Interpretation of Vibration Criteria for Detailed Analysis

Criterion Curve[1]	Max Lv (VdB) [2]	Description of Use
Workshop	90	Distinctly feelable vibration. Appropriate to workshops and non-sensitive areas.
Office	84	Feelable vibration. Appropriate to offices and non-sensitive areas.
Residential Day	78	Barely feelable vibration. Adequate for computer equipment and low-power optical microscopes (up to 20×).
Residential Night, Operating Rooms	72	Vibration not feelable, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power optical microscopes (100×) and other equipment of low sensitivity.
VC-A	66	Adequate for medium- to high-power optical microscopes (400×), microbalances, optical balances, and similar specialized equipment.
VC-B	60	Adequate for high-power optical microscopes (1000×), inspection, and lithography equipment to 3 micron line widths.
VC-C	54	Appropriate for most lithography and inspection equipment to 1 micron detail size.
VC-D	48	Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capability.
VC-E	42	The most demanding criterion for extremely vibration-sensitive equipment.

Notes:
1. As indicated on Figure 3-6.
2. As measured in 1/3-octave bands of frequency over the frequency range 8 to 80 Hz.

Hz = hertz
Max Lv = maximum velocity level in decibels
VC = vibration criteria
VdB = RMS vibration velocity level, dB

Source: FTA 2006

3.3.2 State and Local

Appendix G, Section XI, Item b of the CEQA standards refers to potential vibration impacts. CEQA does not have specific standards listed, but allows the use of standards developed for a given industry. In this case, the most detailed vibration criteria and impacts are included in the FRA methodology; these criteria and impacts are listed in Tables 3-26 through 3-28.

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Section 4.0
Existing Noise and Vibration Conditions

4.0 Existing Noise and Vibration Conditions

4.1 Study Area

The study area for this noise and vibration analysis generally follows the Fresno to Bakersfield HST corridor along the BNSF Railway (BNSF) railroad between the downtown area of the City of Fresno and the downtown area of the City of Bakersfield. This region includes areas and communities within the incorporated boundaries of the Cities of Fresno, Hanford, Corcoran, Wasco, Shafter, and Bakersfield. This area also includes unincorporated communities within the Counties of Fresno, Kings, Tulare, and Kern. The areas within the Cities of Fresno, Corcoran, Wasco, Shafter, and Bakersfield are considered urban/suburban, and most of the unincorporated areas between these cities are considered rural. The proposed station locations fall within the urban areas of the Cities of Fresno and Bakersfield. The potential Kings/Tulare Regional Station is in a rural area east of the City of Hanford. Most of the project areas described above as urban/suburban are also along active rail corridors, as are most of the rural areas.

4.2 Existing Noise Environment

4.2.1 Noise-Sensitive Receptors

Along the proposed right-of-way, noise-sensitive receivers located near the alignment which could potentially be impacted by project-related noise needed to be identified. In order to narrow the area within which noise-sensitive receivers may be located, a series of screening distances were used. The FRA has established screening distances for potential noise impacts based upon existing land use and the speed at which future railroad operations are expected to operate. These FRA guidelines are presented in Table 4-1. Noise-sensitive receivers were identified by locating noise-sensitive land uses (residential, schools, parks, libraries, hospitals, etc.) within the appropriate noise impact screening distances for the proposed project alternatives. In this case, the screening distances used to identify noise-sensitive receivers were developed in accordance with FRA guidance and are presented in Table 4-1.

The noise impact screening distances for noise-sensitive receivers are dependent upon the existing noise environment and the speed of the trains. Ambient noise level measurements were completed at specific noise-sensitive receiver locations within the appropriate noise impact screening distances for each existing noise environment in order to define the current ambient noise levels. For noise impact screening distance purposes, existing noise environments are defined by the existence of rail corridors, the type of existing noise environment based on the nearby population density (urban, suburban, and rural), and whether the noise-sensitive receiver is obstructed or not unobstructed from view of the alternative project alignments. Screening distances change based on the speed of the trains. Trains moving up to 100 mph have a shorter screening distance than trains moving up to 200 mph. Existing noise environments where there is an existing rail corridor have shorter screening distances than existing noise environments that lack an existing rail corridor. Urban and noisy suburban existing noise environments have shorter screening distances than quiet suburban and rural areas. Unobstructed noise-sensitive receivers have larger screening distances than noise-sensitive receivers that have obstructed views of the potential noise source.

Table 4-1
Noise Impact Screening Distances

Existing Noise Environment	Screening Distance for HST (in feet , from centerline)	
	90 to 170 mph	170 or More mph
Existing rail corridor, urban/noisy suburban – unobstructed	300 ft	700 ft
Existing rail corridor urban/noisy suburban – obstructed	200 ft	300 ft
Existing rail corridor, quiet suburban/rural	500 ft	1,200 ft
New rail corridor, urban/noisy suburban – unobstructed	350 ft	700 ft
New rail corridor urban/noisy suburban - obstructed	250 ft	350 ft
New rail corridor, quiet suburban/rural	600 ft	1,300 ft

ft = feet
HST = high-speed train
mph = miles per hour
Source: FRA 2005.

4.2.2 Measured Noise Levels

To establish a base of existing environmental noise levels for project noise impact assessment, a comprehensive series of noise measurements were made within the study area. A combination of 196 long-term (24 hours in duration) and 207 short-term (60 minutes in duration) noise measurements were taken at noise-sensitive receivers. Some measurement sites included multiple measurements. The ambient noise level measurement locations were selected to be representative of the noise environment most likely to be impacted by train noise. Measurements were completed at single-family and multi-family residences for long-term measurements. Short-term measurements were completed at residential and institutional sites (e.g., hospitals, libraries, schools, churches), and were taken to estimate the Ldn at receivers with sleep activity not covered by the 24-hour measurements and to determine the existing conditions at receivers with only daytime activities.

A summary of long- and short-term noise measurements is presented in Tables 4-2 (long–term measurements) and 4-3 (short-term measurements). Each table lists the measurement location identification number, location address, summary of noise sources, additional notes, and the resulting noise level. All of the noise measurement locations and their measure noise levels are shown graphically on figures that can be found in Appendix C. Further details of noise measurement data and documentation, including sample field data sheets and site photos, are provided in Appendix D.

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-1	1331 M. Street	City of Bakersfield	R			X			X		X		64.6
LT-3	9300 Windcreek	City of Bakersfield	R			X	X		X		X	sprinklers	57.8
LT-4	10304 Palm Ave	City of Bakersfield	R						X				71.6
LT-5	1107 Enger St.	City of Bakersfield	R						X				71.6
LT-6	2800 Lona Dala Dr.	City of Bakersfield	R						X		X		74
LT-7	3210 Old Farm Road	City of Bakersfield	R	X					X		X		77.7
LT-8	21541 Paddock Place	City of Bakersfield	R	X		X			X				68.6
LT-9	4340 Sandy Gap	City of Bakersfield	R	X		X			X			rustling leaves	65.1
LT-10	13417 Cheyenne Mtn. Dr.	City of Bakersfield	R			X			X				59.6
LT-11	19491 Santa Fe	City of Bakersfield	R			X			X				78.8
LT-12	19401 Santa Fe	City of Bakersfield	R	X		X			X				72.8
LT-13	31396 Burbank	City of Shafter	R	X	X	X			X				74.4
LT-14	31327 Orange St.	City of Shafter	R	X		X			X				79
LT-15	380 Marengo	City of Shafter	R	X		X			X		X		69.6
LT-16	396 Prince Lane	City of Shafter	R			X			X				74.9
LT-17	17422 Poplar	City of Shafter	R	X		X			X			agricultural	79.4
LT-18	17037 Scaroni	City of Shafter	R	X		X			X				72.7
LT-19	16202 Wasco Ave	City of Wasco	R	X		X			X		X	rustling leaves	72.8
LT-20	15850 Wasco Ave	City of Wasco	R	X		X			X		X		59.9
LT-21	29502 Unnamed Street	City of Wasco	R	X		X			X	X		Agricultural land	58.7
LT-22	1886 G. Street	City of Wasco	R	X					X				73.2
LT-23	29352 HWY 46 (Paso Robles Hwy)	City of Wasco	R			X		X	X	X	X		73.4
LT-24	29136 McCombs Road @ Annin Ave	City of Wasco	R	X	X	X			X				63
LT-25	29351 Whistler Road	City of Wasco	R	X		X			X				62.7
LT-26	13436 Hwy 43	City of Wasco	R	X		X			X				72
LT-27	29348 Blankenship	City of Wasco	R	X		X			X				62.1

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-28	29350 Peterson	City of Wasco	R	X		X			X			agricultural	67.2
LT-29	29305 Second St.	City of Wasco	R	X		X			X				73.6
LT-30	29140 Pond Road	City of Wasco	R	X		X			X				72.3
LT-31	13767 Cherry Ave.	City of Shafter	R	X		X			X		X		71.1
LT-32	1499 E. Los Angeles St.	City of Shafter	R	X	X	X		X	X				64.4
LT-33	East Lerdo Hwy (between S. Beech Ave. and Cherry Ave)	City of Shafter	R			X			X				67.2
LT-34	1991 East Lerdo Hwy	City of Shafter	R	X		X			X				66.6
LT-35	460 Pine Street	City of Shafter	R			X			X				59.4
LT-36	1450 E. Lerdo Hwy	City of Shafter	R	X		X		X	X				61.4
LT-37	625 E. Fresno Ave.	City of Shafter	R			X			X				58.6
LT-38	30519 Maderar	City of Shafter	R						X				59.5
LT-39	17259 Shafter Ave.	City of Shafter	R			X			X				69.2
LT-40	17207 Mettler Ave.	City of Shafter	R						X				59.1
LT-41	30348 Madera Ave.	City of Shafter	R						X				58.4
LT-42	17096 Shafter Ave.	City of Shafter	R						X				61.6
LT-43	30592 Merced Ave.	City of Shafter	R						X				53.7
LT-44	28901 W. Cecil Way	City of Delano	R			X			X				65.6
LT-45	Garces Hwy @ Central Valley Hwy	City of Delano	R	X	X	X			X				71.4
LT-46	11098 Hwy 43 (Central Valley Hwy)	City of Delano	R	X		X			X				73.1
LT-47	11248 Airport Ave, Wasco	City of Wasco	R	X					X				59.9
LT-48	8611 Ave. 32, Delano	City of Delano	R			X			X				76.1
LT-49	3400 Road 84, Earlimart	County of Tulare	R	X		X			X				64.5
LT-50	8512 36th Ave., Earlimart	County of Tulare	R	X		X			X				62

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-51	8369 Road 84, Earlimart, CA (@ Ave. 39)	County of Tulare	R	X		X			X				68.7
LT-52	9444 Hwy 43	County of Tulare	R	X		X			X				64.4
LT-53	9582 Hwy 43	County of Tulare	R	X		X			X				64
LT-54	9952 Hwy 43	County of Tulare	R	X		X			X				64.6
LT-55	3922 Ave. 120	City of Corcoran	R	X		X		X	X				65.2
LT-56	28704 Garces	City of Delano	R			X			X		X	rustling leaves	61.5
LT-57	11446 Palm Ave.	City of Delano	R	X					X		X		59.8
LT-58	12728 Ave. 128	City of Corcoran	R	X		X			X		X		64.9
LT-59	2364 Ave. 144	City of Corcoran	R	X		X			X		X		65.2
LT-60	1847 Ave. 144	City of Corcoran	R	X		X			X		x		70.4
LT-61	14624 Hwy 43	City of Corcoran	R	X		X			X		X		66
LT-62	277 Oregon Ave.	City of Corcoran	R	X		X		X	X				61.4
LT-63	83 Whitley, Corcoran	City of Corcoran	R	X		X			X				68
LT-64	825 Yoder @ Brokaw	City of Corcoran	R	X		X			X				80.7
LT-65	1420 North Avenue	City of Corcoran	R	X		X			X			apartments	78.4
LT-66	5904 Newark	City of Corcoran	R	X		X			X		X		64.4
LT-67	1940 Dairy Ave.	City of Corcoran	R	X		X			X				65.5
LT-68	5701 Niles, Corcoran	City of Corcoran	R	X		X			X				64.1
LT-69	172 Orange Dr.	City of Corcoran	R			X			X		X		47.6
LT-70	21 5th Avenue	City of Corcoran	R						X		X		51.1
LT-71	152 5 1/2 Avenue	City of Corcoran	R			X			X		X		72.9
LT-72	455 Orange Ave.	City of Corcoran	R			X			X		X		52.5
LT-73	5974 Corcoran Hwy	City of Corcoran	R			X			X				65.4
LT-74	23088 51/2 Ave.	City of Corcoran	R			X			X				55.9
LT-75	23489 Hwy 43	City of Corcoran	R	X		X			X				71.7
LT-76	7370 Kansas Ave	City of Hanford	R			X			X		X		72.6
LT-77	7549 Kansas Ave	City of Hanford	R			X			X				54.3

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-78	7685 Kansas Ave	City of Hanford	R			X			X				71
LT-79	7520 Kent Ave	City of Hanford	R			X	X		X		X	agricultural	57.8
LT-80	7290 Kent Ave	City of Hanford	R	X		X			X		X		55.7
LT-81	7530 Jersey Ave	City of Hanford	R			X			X		X		57.3
LT-82	15664 7th Ave	City of Hanford	R			X			X		X	agricultural	58.5
LT-83	7577 Jackson Ave	City of Hanford	R			X			X				58.9
LT-84	14976 7th Ave @ Jackson	City of Hanford	R	X		X			X				58
LT-85	14419 8th Ave	City of Hanford	R			X			X				55.5
LT-86	7025 Idaho Street	City of Hanford	R			X		X	X			pump 75 yards away	65.2
LT-87	7343 Houston	City of Hanford	R			X			X				67.9
LT-88	7740 Houston	City of Hanford	R			X	X	X	X				64.9
LT-89	7480 Hanford - Armona Road	City of Hanford	R			X	X		X			Crop Dusters at location	57.9
LT-90	7818 Hanford - Armona Road	City of Hanford	R			X	X		X		X		58.3
LT-91	10535 8th Avenue	City of Hanford	R			X	X		X		X		52.3
LT-92	9944 Ponderosa	City of Hanford	R			X		X	X		X		60.2
LT-93	9724 Ponderosa	City of Hanford	R			X	X		X		X		55.3
LT-94	7794 Grangeville Blvd	City of Hanford	R			X			X		X	Rustling Leaves	56
LT-95	7974 Grangeville Blvd	City of Hanford	R			X			X				60.4
LT-96	8791 8th Avenue	City of Hanford	R			X			X				59.5
LT-97	8361 Flint	City of Hanford	R			X	X	X	X		X		55.3
LT-98	8290 Flint	City of Hanford	R			X			X			Fountain / Pool	56
LT-99	7895 Fargo	City of Hanford	R			X	X		X		X		58.5
LT-100	7755 Fargo	City of Hanford	R	X		X	X		X		X		60.6
LT-101	6141 8 1/2 Avenue	City of Hanford	R			X		X	X		X		49.6
LT-102	8352 Elder	City of Hanford	R			X			X				48.8

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-103	8125 Elder	City of Hanford	R			X			X				46.7
LT-104	8813 Excelsior	City of Hanford	R				X		X		X		63
LT-105	4490 9th Avenue	City of Hanford	R			X			X		X		57.5
LT-106	3739 9 1/2 Avenue	City of Hanford	R						X		X		49.9
LT-107	10560 Denver	City of Hanford	R	X		X			X		X		53.8
LT-108	3127 10 1/2 Avenue	County of Fresno	R					X	X		X		50.6
LT-109	2853 Boundary Road	County of Fresno	R			X			X		X		61.3
LT-110	8066 E. Riverdale	County of Fresno	R			X		X	X		X		63.1
LT-111	5606 Davis	County of Fresno	R			X	X		X		X		56.9
LT-112	5083 E. Elkhorn	County of Fresno	R			X			X		X		63.5
LT-113	16257 S. Minnewawa	County of Fresno	R				X		X		X		63.7
LT-114	4224 Clarkson	County of Fresno	R	X					X				66.3
LT-115	15521 Peach	County of Fresno	R	X		X			X		X		74.1
LT-116	14474 Willow	County of Fresno	R	X					X		X		63.7
LT-117	3289 Kamm	County of Fresno	R	X		X			X				64.5
LT-118	13198 Chestnut	County of Fresno	R	X		X			X		X		70.2
LT-119	2313 Mountain View	City of Fresno	R	X		X			X		X		67.6
LT-120	2960 E. Nebraska	City of Fresno	R	X		X		X	X		X		77
LT-121	2625 E. Rose	City of Fresno	R	X		X			X		X		65.8
LT-122	2530 E. Floral	City of Fresno	R	X		X			X				75.1
LT-123	2311 Dinuba	City of Fresno	R	X					X		X		64.4
LT-124	2342 E. Springfield	City of Fresno	R	X					X		X		70.2
LT-125	8179 S. Maple	City of Fresno	R	X		X			X				58.1
LT-126	2047 E. Adams	City of Fresno	R	X	X	X			X				66.8
LT-127	2070 Clayton	City of Fresno	R	X	X	X			X				65.9
LT-128	5511 S. Maple	City of Fresno	R			X		X	X				64.9
LT-129	2235 Malaga	City of Fresno	R	X		X			X		X		79.3
LT-130	2109 Malaga	City of Fresno	R	X		X			X				69.4

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-132	2366 S. Grace	City of Fresno	R	X		X			X				75.2
LT-133	2201 Nicholas Ave.	City of Fresno	R			X			X				70.8
LT-134	205 F Street	City of Fresno	R			X			X				68.5
LT-135	158 N. Roosevelt	City of Fresno	R			X			X				69
LT-136	239 N. Ferger	City of Fresno	R			X			X				68.3
LT-137	718 Arthur Ave	City of Fresno	R			X			X				71.8
LT-138	425 N. Westley	City of Fresno	R	X		X			X				61.8
LT-139	937 N. Fruit Ave	City of Fresno	R			X			X				68.8
LT-140	1219 Esther	City of Fresno	R			X			X				72.1
LT-141	1286 Esther	City of Fresno	R			X			X				66.3
LT-142	1941 N. Golden State Hwy	City of Fresno	R	X		X			X			Arcade Trailer Park	73.2
LT-143	1647 W. Normal	City of Fresno	R	X		X			X				71.6
LT-144	1415 W. McKinley	City of Fresno	R	X	X	X			X				77.3
LT-145	18455 Driver Road	City of Shafter	R						X				57.2
LT-146	16455 Shafter Road	City of Shafter	R			X			X				55.3
LT-147	2502 Zachary Ave	City of Shafter	R			X			X				57.8
LT-148	Unnamed Road - Between Gromer Ave and McCombs Ave	City of Wasco	R			X			X				61.4
LT-149	Corner of 6th Street and Root Ave	City of Wasco	R			X			X				55.1
LT-150	1636 Broadway	City of Fresno	R			X			X				61
LT-151	517 Farris	City of Fresno	R			X			X				67.5
LT-152	1503 C Street	City of Fresno	R			X			X				64.2
LT-153	635 Fresno Street @ Pottle	City of Fresno	R			X			X				64.5
LT-154	1127 Tulare St.	City of Fresno	R			X			X				64.6
LT-155	1105 Kern Street	City of Fresno	R			X			X				62.8
LT-156	248 N. Van Ness Ave.	City of Fresno	R			X			X				60.9

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-157	310 N. Fulton Street @ Mildreda Ave.	City of Fresno	R			X			X				66.4
LT-158	405 Effie	City of Fresno	R			X	X		X		X		67.1
LT-159	415 Delores	City of Bakersfield	R	X		X			X				63.1
LT-160	725 Eureka Street	City of Bakersfield	R			X			X				59.4
LT-161	1306 E. 19th Ave	City of Bakersfield	R	X		X			X				68.3
LT-162	1430 Eureka	City of Bakersfield	R	X		X			X				58.1
LT-163	1054 Washington Street	City of Bakersfield	R	X		X			X			Govea Gardens Apartments	66.1
LT-164	827 Chico Street @ Beale Ave	City of Bakersfield	R			X			X				61.8
LT-165	1414 11th Street	City of Bakersfield	R	X		X			X				63.2
LT-166	2126 Larcus Street	City of Bakersfield	R			X			X				61
LT-167	1106 Quantico Street	City of Bakersfield	R	X		X			X				59.1
LT-168	2900 Citrus Ave	City of Bakersfield	R	X		X			X				61.2
LT-169	2001 Kentucky Street	City of Bakersfield	R	X		X			X				66.3
LT-170	2333 Center Street,	City of Bakersfield	R R	X		X			X				63.5
LT-171	2619 Trust Street	City of Bakersfield	R	X		X			X				62.5
LT-172	2903 Pioneer Dr. (Edison Village)	City of Bakersfield	R	X		X			X				57.4
LT-173	721 Oswell Street (Black & White Mobil Home Lodge)	City of Bakersfield	R	X		X			X				71.1
LT-174	3309 Camellia Street	City of Bakersfield	R	X		X			X				70.2
LT-175	301 Cooley Drive	City of Bakersfield	R	X		X			X				72.3
LT-176	6601 Eucalyptus Drive	City of Bakersfield	R	X		X			X			Cement wall between instrument and tracks	60.4
LT-177	706 Zinara St.	City of Bakersfield	R	X					X				67.4
LT-178	4312 Deacon	City of Bakersfield	R			X			X				61.1

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	L_{dn} (dBA)
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds		
LT-179	250 Fairfax Road (Bakersfield Palms RV Resort)	City of Bakersfield	R	X		X			X			Cement wall between instrument and tracks	66.6
LT-180	7749 Mills Drive	City of Bakersfield	R	X		X			X		X		64.6
LT-181	426 Monica Street	City of Bakersfield	R	X					X				65.8
LT-182	8633 E. Brundage Lane	City of Bakersfield	R	X		X			X				68.1
LT-183	9307 Brillow Drive	City of Bakersfield	R	X		X			X				61.7
LT-184	355 S. Vineland Road	City of Bakersfield	R	X	X	X			X				66
LT-185	963 Buna Lane	City of Bakersfield	R	X		X			X				65.9
LT-186	12252 Atlantic Street	City of Bakersfield	R	X		X			X				65.6
LT-187	1660 Pine Street @ Truxtun Ave	City of Bakersfield	R	X		X			X				66.8
LT-188	2009 California Street	City of Bakersfield	R			X			X	X			69.7
LT-189	701 Oleander Avenue	City of Bakersfield	R			X			X				60.5
LT-190	301 A Street @ 3rd Street	City of Bakersfield	R			X			X				62.3
LT-191	1621 6th Street	City of Bakersfield	R			X			X				68.6
LT-192	1015 O Street (Corner of N and 11th)	City of Bakersfield	R			X			X				63.8
LT-193	906 3rd Street (Corner of P and 3rd)	City of Bakersfield	R			X			X				69
LT-194	200 Texas Street (Corner of Texas and King)	City of Bakersfield	R			X			X				64.6
LT-197	2311 19th Street	City of Bakersfield	R			X			X		X		67.8
LT-198	2323 Spruce	City of Bakersfield	R			X			X				71.3
LT-199	2330 21st Street	City of Bakersfield	R			X			X				65.9
LT-200	528 Monterey	City of Bakersfield	R			X			X				63.8
LT-201	19948 S. Fowler Ave.	City of Laton	R	X		X			X				66.2
LT-202	21030 S. Fowler Ave.	City of Laton	R	X		X			X				67.4

Table 4-2
Long-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources: Rail	Grade Crossing	Roadway	Aircraft	Industrial/Commercial	Community/Household	Children Playing	Dogs/Birds	Comments	L_{dn} (dBA)
LT-203	4767 12th Ave.	City of Hanford	R	X					X				62.1
LT-204	2264 N. Heron Dr.	City of Hanford	R	X		X			X				70.7
LT-205	2098 N. Heron Dr.	City of Hanford	R	X		X			X				71.1
LT-206	444 Ford St.	City of Hanford	R	X		X			X				77.3
LT-207	807 W 7th St.	City of Hanford	R	X		X			X				60.5
LT-208	18026 10th Ave.	City of Hanford	R	X					X				76.5
LT-209	2043 Kings Road	City of Hanford	R	X					X				68.9
LT-210	1005 W. Water St.	City of Hanford	R	X					X				70.5
LT-211	10833 Malta St.	City of Hanford	R	X					X				67.0
LT-212	502 Phillips St.	City of Hanford	R	X		X			X				70.4
LT-213	1125 Rodgers Rd.	City of Hanford	R	X		X			X				65.8
LT-214	1515 Thornton St.	City of Hanford	R	X		X			X				73.6
LT-215	410 Scott St.	City of Hanford	R	X					X				74.0
LT-216	4728 12th Ave.	City of Hanford	R	X					X				59.9
LT-217	4592 12th Ave.	City of Hanford	R	X					X				61.5

dBA = A-weighted decibels
L_{dn} = day-night sound level, dBA
LT = long-term
Source: Data provided in tables in this report were compiled by the URS staff listed in Chapter 11.

The short-term noise measurements summarized in Table 4-3 include the actual measured short-term L_{eq} values as well as the estimated L_{dn} values. These values were estimated by comparing the short-term measured values to the corresponding L_{eq} values at a nearby long-term measurement location subjected to a similar characteristic noise environment according to the following method:

A. Note the L_{eq} value for the short-term measurement (generally 60 minutes).

B. Compare the monitored short-term (ST) L_{eq} value from step A to the monitored L_{eq} value for the nearby long-term (LT) measurement location for the same measurement period used for the short-term (ST) L_{eq} value.

Then

L_{eq} (ST) – $L_{eq(simultaneous)}$ (LT) = delta

and

L_{dn} (ST) = L_{dn} (LT) + delta

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-1	Bakersfield High School (14th and F Street)	City of Bakersfield	I	X		X	X			X	X	Train @ 11:45, 12:45	59.5	69.1
ST-2	2215 Truxton Ave.	City of Bakersfield	R	X		X	X					Fan/Exhaust system for Hospital humming; Locomotives moving around; Air brakes in train yard	77.8	79.9
ST-3	Intersection of Myrtle and California	City of Bakersfield	R			X			X		X	Traffic	71.4	72.1
ST-4	Jastro Park	City of Bakersfield	I			X			X			Intersection of Myrtle and Truxton	68.7	71.2
ST-5	Beale Memorial Library (701 Truxton Ave)	City of Bakersfield	I	X		X					X	Amtrak Station on South Side	57.8	67.7
ST-6	Franklin Elementary School (2400 Truxton Ave)	City of Bakersfield	I	X		X	X		X				65	68.8
ST-7	1109 Harvest Creek	City of Bakersfield	R			X	X		X		X		64.9	69.0
ST-8	8600 Lyn River	City of Bakersfield	R			X	X		X			Across street from Medical Building	67.4	71.4
ST-9	Jewetta Ave (Suncrest RV Park)	City of Bakersfield	R	X		X			X			Train @ 15:53, 15:58	59.8	64.2

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-10	2050 Verdugo Lane	City of Bakersfield	R	X		X			X		X	Train EB, Train WB	57	68.8
ST-11	2001 Dean Ave	City of Bakersfield	R	X		X			X		X	Nearby Landscaping; Train @ 10:53, 11:30	55.3	54.3
ST-12	3209 Nebula Court	City of Bakersfield	R	X			X		X		X	Train @ 10:41, 11:15	58.5	59.5
ST-13	4408 Allen Road	City of Bakersfield	R	X	X	X			X		X	Multiple train horns	74.7	75.7
ST-14a	14527 Palm Ave	City of Bakersfield	R	X	X	X	X		X			Train @ 12:55	53.4	65.9
ST-14b	14527 Palm Ave	City of Bakersfield	R	X	X	X	X		X			Nearby tractor; train horn @ 12:10	49	64.1
ST-15	13017 Hageman Frontage Road	City of Bakersfield	R			X	X		X		X	Nursery	65.8	78.4
ST-16	Frontier High School (6401 Allen Road)	City of Bakersfield	I	X	X	X	X			X		Behind High School Bleachers; Train horn	43.8	58.9
ST-17	Pentecostal Church of God +house (32186 7th Standard)	City of Bakersfield	I	X	X	X			X				66.6	78.1
ST-18	19441 Santa Fe Rd.	City of Bakersfield	R	X	X	X			X			Train horns	71.6	83
ST-19	31363 Orange St.	City of Shafter	R	X	X				X		X	Train horns @ 11:32, 11:50, 12:00	46.7	61.2
ST-20	18631 Santa Fe Rd.	City of Shafter	R	X	X	X			X		X	SB AMTRAK 1/4; vehicle traffic	52.8	67.3
ST-21	1240 Los Angeles	City of Shafter	R	X	X	X			X			Train @ 13:40, 14:00	57.1	65.8
ST-22	455 E. Ash	City of Shafter	R	X	X	X			X			NB AMTRAK 1/4; Freight train 2/70+; SB Freight 3/65/3	58	66.7

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-23	511 Jackson	City of Shafter	R	X	X	X				X		Train @ 15:37 - 4 locomotives	68.3	69.6
ST-24	Shafter High School (526 Mannel Ave.)	City of Shafter	I	X	X	X				X		Multiple train horns	60.2	68.3
ST-25	29600 Kimberlina	City of Wasco	R	X	X				X			AMTRAK train horn @ 13:44	42.5	48.2
ST-26	29895 Merced Avenue	City of Wasco	R	X	X	X			X			Southeast Corner of Merced and Highway 43	72	72.7
ST-27	715 Mayer Lane	City of Wasco	R	X	X	X			X	X	X		68.1	72.5
ST-28	Redwood Elementary School (331 Shafter Ave)	City of Wasco	I	X	X	X						Train @ 10:24 (AMTRAK - 1 locomotive)	64.2	70.7
ST-29	397 Fresno Avenue	City of Wasco	R			X	X				X		58	64.4
ST-30	Prospect and Hwy 43	City of Wasco	R	X	X	X						Train @ 2:30pm	63.6	69
ST-31	Kimberlina	City of Wasco	R	X		X					X	Freight Train 3/73/2	63.3	68.7
ST-32	Theresa Burke Elementary School (Filburn and Griffith, Wasco)	City of Wasco	I	X		X	X		X	X			56.2	61.8
ST-33	15848 Griffith Ave	City of Wasco	R	X		X	X		X	X	X	Train NB 6/70 & train SB 2/60	42.7	48.2
ST-34	4th Street @ F Street	City of Wasco	R	X		X	X	X		X		Trains passed @ 11:25, 11:37-11:38, 11:45, 12:15; Steady low hum from auto shop ventilation across street	69	70.9
ST-35	Wasco Child Development Center (764 H Street)	City of Wasco	I	X	X	X						Freight train SB 4/<60, NB 4/60, SB 2 engines, NB freight 4/60	67.4	69.3

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-36	St. Johns School (9th Street @ Broadway)	City of Wasco	I	X		X			X	X	X		60.6	66.7
ST-37	Filburn Ave	City of Wasco	R	X		X			X		X	Train horn 54+dBA	38.1	57.8[1]
ST-38	Karl F. Clemens Middle School (5th Street @ Broadway)	City of Wasco	I	X		X	X		X	X	X	Loud train horn sounded @ 15:34, 15:38-15:40, 16:24	63.3	67.4
ST-39	Thomas Jefferson Middle School (Griffith @ 1st Street)	City of Wasco	I	X		X				X	X	Lots of traffic noise	57.9	63
ST-40	Gromer Avenue @ Annin Street	City of Wasco	R	X	X	X			X		X	Train passed location @ 9:16, 9:37, 9:58	60.4	65.6
ST-41	Hwy 43 @ Taussig Ave	City of Wasco	R	X		X					X	AMTRAK passes 13:53	64.9	72.4
ST-42	28994 Taussig Ave	City of Wasco	R			X	X		X			Roadway getting wet from light showers	62.2	69.6
ST-43	28998 Blakenship	City of Wasco	R	X							X	Machinery in adjacent field, BNSF 15:10, 15:31, 15:33	49.5	55
ST-44	29398 Blankenship Avenue	City of Wasco	R	X		X			X				49.8	55.4
ST-45	29370 Peterson Road	City of Wasco	R	X		X			X		X	Car passed by @ 11:50, 11:51, 11:55, 12:00, 12:02, 2:12:09, 12:20, 12:23, 12:38, 12:37; Distant train horn @12:31	60.2	65.7
ST-46	29380 Elmo near Hwy 43	City of Wasco	R			X						Tractors idling	55.5	66.9

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-47	29160 Pond Road	City of Wasco	R	X		X					X	Trains pass @ 15:21, 15:59	69	69.9
ST-48	11815 Pond Road, Wasco	City of Wasco	R	X		X				X	X	AMTRAK 1/4	58.3	64.9
ST-49	31793 Riverside Street	City of Shafter	R			X	X		X		X	Four wheeler and truck passed @ 14:34; Plane overhead and tractor in distance @ 14:37	53.6	45.4
ST-50	18455 Driver Road	City of Shafter	R			X	X		X		X	Lots of animal noise from farm; airport landing path	55.5	47.3
ST-51	Fresno Ave	City of Shafter	R	X		X			X	X		Children playing basketball 11yrds NW; Large school bus @ 14:54; Lawnmower in distance @ ~14:53	59.7	66
ST-52	Field @ corner of Beech & Canal	City of Shafter	R	X		X			X	X		School busses, train horn, soccer kids running by	43.9	50.1
ST-53	30998 Fresno Ave.	City of Shafter	R	X			X		X		X	Aircraft overhead throughout	56.5	61.3
ST-54	1740 Beech	City of Shafter	R			X	X		X		X	Low flying plane over crops; Thunderous booms (hammering) from nearby warehouse	61.6	66.4
ST-55	350 Pine Street	City of Shafter	R	X		X			X		X	Landscaping	55.4	62.1
ST-56	1190 Weyand Way @ State Street	City of Shafter	R	X			X				X	Train horns in distance; low flying planes	73.3	62.1
ST-57	31145 Fresno	City of Shafter	R	X		X	X						52.3	62.1

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-58	17431 Mannel Avenue	City of Shafter	R			X			X		X		52.7	62.1
ST-59	Mannel Avenue	City of Shafter	R	X		X		X	X		X	Constant generator noise from Oil Derek	54.7	64.1
ST-60	Shafter Avenue	City of Shafter	R	X		X			X		X		57.1	57.5
ST-61	17413 Mettler	City of Shafter	R	X		X	X				X	Train horns in distance	52.4	52.8
ST-62	155 Redwood Drive	City of Shafter	R			X	X						54.8	61.3
ST-63	100 Walker Street (Behind Shafter Museum)	City of Shafter	R	X		X					X	NB Freight train 4/60+ as well as train horns	67.7	74.1
ST-64	Merced Avenue	City of Shafter	R			X						Rustling leaves	63.6	65.6
ST-65	Unknown	City of Shafter	R			X				X		Rustling leaves and a lot of vehicle traffic	55	58.6
ST-66	17052 Shafter Avenue	City of Shafter	R	X		X			X			rustling leaves	45	51.4
ST-67	Merced Avenue	City of Shafter	R	X		X			X		X	Train horn in the distance	55.3	61.7
ST-68	30345 Merced Avenue	City of Shafter	R			X						Large truck passed @ 13:57	60.8	59.1
ST-69	Merced Avenue	City of Shafter	R			X	X		X		X		60.2	66.6
ST-70	30749 Merced	City of Shafter	R						X				59.1	65.9
ST-71	29140 Schuster Road	City of Shafter	R	X		X			X			Train passed @ 13:55	47.7	66.7[1]
ST-72	Schuster Road	City of Wasco	R	X		X					X		60.2	65.4

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-73	11242 Hwy 43	City of Wasco	R			X				X		School bus stopped near meter @ 15:15	68.1	72.2
ST-74	Schuster Road	City of Wasco	R			X							62.9	66.9
ST-75	28994 Garces Hwy	City of Wasco	R	X		X			X				60	65.3
ST-76	28820 Garces Hwy	City of Wasco	R	X		X					X	Constant generator noise	65.9	61.5
ST-77	2990 Road 84	Earlimart	R			X	X		X	X	X	Children walked by and talked to tester @ 15:53; Kids began to play @ 16:07	49	51.3
ST-78	8830 Avenue 24	Earlimart	R	X	X	X					X	AMTRAK NB passed location	63.2	65.6
ST-79	Avenue 32	Earlimart	R			X	X				X	Dogs barked @ 9:52; Loud aircraft in distance @ 10:06; Dogs barked @ 10:08-10:10	47.4	68.7[1]
ST-80	3442 Road 84	Earlimart	R	X		X					X	Rooster crowing in distance	53.7	64.5
ST-81	4011 Road 84	Earlimart	R	X	X	X		X					64.4	71.2
ST-82	3764 Road 84	Earlimart	R	X		X			X			Heavy trucks on Hwy 43; AMTRAK SB, Slow Freight NB; Fast freight train SB	58.4	65.1
ST-83a	Ave 108	City of Corcoran	R	X		X			X		X	Heavy machinery operating @ 12:54-13:04; Vehicle traffic a2 12:13, 12:21, 12:30, 12:42, 12:53; Train passed @ 12:57	52.5	57.4
ST-83b	Ave 108	City of Corcoran	R	X		X					X	Tractor working in field moved closer and is much louder @ 15:35	53.4	62.4

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-84	11200 Hwy 43 @ Ave 112	City of Corcoran	R	X	X	X	X				X	Birds; Tractor; Aircraft; AMTRAK EB @ 15:07 4/1; BNSF EB @ 15:17 3/47/0; BNSF Freight EB @ 15:26 4/48/0	47.8	62.4
ST-85	28794 Shuster Ave, Wasco	City of Wasco	R			X			X		X		53.8	59.8
ST-86	Schuster Road near Palm Ave	City of Wasco	R	X		X					X	Small dog barking; AMTRAK train passing at 14:01; Car leaving @ 14:12	41.8	60.9
ST-87	28384 Garces Hwy	City of Wasco	R			X					X		65.3	70.3
ST-88	11237 Magnolia	City of Wasco	R			X		X		X	X	ATV passed @ 3:08; School bus drop-off @ 3:39; Cars and Trucks passing by @ 14:16, 15:53	58.6	63.5
ST-89	3141 Avenue 36	Earlimart	R	X	X	X					X	Distant trains and vehicles	41.4	59.5
ST-90	14942 Hwy 43	City of Corcoran	R	X		X	X					Heavy trucks @ 14:40, 14:44, 14:46; Freight train 14:52-14:53; Planes overhead @ 15:00, 15:18	60.7	68.2
ST-91	710 Hanna Avenue	City of Corcoran	R	X		X			X		X	Train passed @ 15:00	61.2	69.9
ST-92	747 Hall Avenue	City of Corcoran	R	X		X		X			X	Heavy traffic in area; generator started running @ 14:55; Trains passing @ 14:40 - AMTRAK NB, 15:04 AMTRAK SB	59.8	68.5
ST-93	1000 Paterson	City of Corcoran	R	X		X							70	78.4

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-94	614 Otis (Kings Mobile Lodge)	City of Corcoran	R	X		X					X	Heavy Trucks passed @ 10:04, 10:09, 10:41; Train horn sounded @ 10:14; 2 Locomotives passed @ 10:15	70.3	78.4
ST-95	Hale Street @ North Avenue	City of Corcoran	R			X					X		60.7	62
ST-96	6269 Newark Road	City of Corcoran	R	X		X					X	Train passed @ 10:31	49.3	61.6
ST-97	320 Otis	City of Corcoran	R	X	X	X			X		X	SB Freight train stopped at intersection and idling @ 10:15, airbrakes; SB Train @ 10:45	64.5	76.8
ST-98	23756 5th Avenue	City of Corcoran	R			X					X	ATV passed location @ 14:00-14:05; Cars passed @ 14:20	59.4	62.6
ST-99	306 5th Avenue	City of Corcoran	R	X		X			X			Train horn in the distance @ 14:25	54.5	57.7
ST-100	5th Avenue @ Niles Road	City of Corcoran	R			X							43.4	49.5
ST-101	23261 5th Avenue	City of Corcoran	R	X		X	X		X		X	Cars passed location @ 11:17, 11:28, 11:31, 11:39, 12:03; Plane overhead @ 11:27; Train horn @ 12:01, 12:03, 12:04	46.9	47.3
ST-102	23340 5 1/2 Avenue	City of Corcoran	R	X		X			X		X	A lot of traffic at this location	61.8	62.2
ST-103	22075 8th Avenue	City of Hanford	R			X					X		55.7	59.4
ST-104	7603 Kent Avenue	City of Hanford	R	X		X	X		X		X		54.8	60.2

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-105	16299 7th Avenue	City of Hanford	R	X		X	X		X			Cars passed by @ 12:39, 12:40, 12:43, 12:45, 12:49, 13:00; Motorcycle passed @ 12:50; Train Passed @ 1:03; Train Horns (4) @ 1:06	59.6	60.5
ST-106	16680 7th Avenue	City of Hanford	R			X	X		X			Crop duster and multiple jets above @ 12:45, 12:56 (2 F-18's)	59.6	60.5
ST-107	12051 8th Avenue @ Hwy 43	City of Hanford	R			X			X				57.8	58.7
ST-108	13320 7th Avenue	City of Hanford	R			X	X		X		X	Airplane overhead @ 9:57, 10:31; Saw running @ 10:30	52.2	57.2
ST-109	13012 7th Avenue	City of Hanford	R			X	X				X	Airplane overhead @ 9:58	55.2	60.2
ST-110	7696 Grangeville Road	City of Hanford	R			X	X				X		52.6	59.7
ST-111	8229 Flint Avenue	City of Hanford	R	X		X			X		X		55.2	58.8
ST-112	7746 Fargo	City of Hanford	R			X	X	X			X	Lawnmower @ 12:04	52.5	58
ST-113	7968 Fargo	City of Hanford	R	X		X			X		X	Car passed location and jet above	51.7	56
ST-114	3295 10th Avenue	City of Hanford	R			X							65.4	68
ST-115	Clarkson	Selma	R	X		X					X	Train horn sounded @ 14:28 (6-7 times); Train passed @ 14:54	58.6	59.2
ST-115b	16495 Minnewawa	Selma	R	X		X						NB Train and SB train	55.4	61.9
ST-116	14677 South Willow	Selma	R	X			X		X		X	Train passed at 11:43, 12:05	53.2	58.6

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Household	Children Playing	Dogs / Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-117	2136 Rose Ave	Selma	R	X		X	X		X		X	Residents, car starting & leaving location @ 10:42-10:43; Train horn @ 10:43; Passing Train WB 10:44:30; Dogs at residence barking occasionally; Resident car @ 10:55	62.6	65.3
ST-118	Monroe Elementary School (On Chestnut)	City of Fresno	I			X		X			X	Occasional traffic on non-school day ~35mph	58.7	64.1
ST-119	12382 Chestnut	City of Fresno	R	X		X			X			Train horn sounded - Locomotives 2 front 2 back	56.7	62.2
ST-120	8254 Cedar	City of Fresno	R	X		X	X		X		X	Rural highway area	53.6	58.6
ST-121	Pacific Union Elementary School (Corner of Rowell and Bowles)	City of Fresno	I	X		X			X		X	Helicopter overhead; Motorcycle @ 14:20; Train @ 14:22	55.6	60.7
ST-122	2419 Manning Avenue	City of Fresno	R			X			X		X	Tractor, Vineyard ATV	63.2	70.2
ST-123	2189 East Morton	City of Fresno	R	X		X	X				X	Train horn @ 14:54; Train passed location @ 15:33-15:36	65.2	60.9
ST-124	2120 American	City of Fresno	R	X		X	X				X	Train horn @ 14:52, 15:29:30; Train passed with 4 locomotives @ 15:17-15:20; Train passed by slowly @ 15:36-15:40	64.1	66.2
ST-125	2097 Jefferson	City of Fresno	R	X		X			X		X	SB and NB trains passed location	66	61.6

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Household	Children Playing	Dogs / Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-126	4199 Cedar Avenue	City of Fresno	R			X			X		X		63.6	68.9
ST-127	2233 Church Street	City of Fresno	R	X		X	X	X				Traffic on Golden State Hwy, Traffic on Church Street, Train horn & Train, Aircraft	63.5	66.8
ST-128	1814 H Street	City of Fresno	R	X		X	X					Traffic on H Street & Amador St.; Some construction traffic; AMTRAK train horn; BNSF train horn, Helicopter	57.1	59.4
ST-129	Motel Drive @ Olive Street (Roeding Park)	City of Fresno	R	X		X					X	Distant trains	61.4	68.6
ST-130	704 Adeline Avenue	City of Fresno	R	X		X			X		X		55.6	59.7
ST-131	1636 Broadway	City of Fresno	R	X		X	X	X	X			Distant construction and train	59.7	63.9
ST-132	660 F Street	City of Fresno	R	X				X	X			Dairy plant exhaust fan	60	63.7
ST-133	852 Divisidero (Iron Bird Lofts)	City of Fresno	R	X		X	X	X	X			Traffic on Divisidero & Fulton; Train - up; Aircraft from FAT; BNSF Horn; Talking	55.4	60.7
ST-134	1383 N. Golden State Blvd (Town House Motel)	City of Fresno	R	X		X		X				Traffic on G.S. Blvd; Traffic on West; UP Train & Horn	56.2	62.3
ST-135	1436 University Avenue	City of Fresno	R			X	X	X				recycling center	55.8	68.6
ST-136	1631 Weldon Avenue	City of Fresno	R	X		X			X		X	BNSF Horns, UP Train Horns	54.6	58.3
ST-137	1224 University	City of Fresno	R	X		X						UP Train and Horn	58.2	58.2

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-138	1125 West Avenue or Northwest Avenue	City of Fresno	R			X			X		X	motorcycle @ 12:34, 12:50, 12:52	56.9	66.7
ST-139	Fremont Elementary School (University Avenue)	City of Fresno	R	X		X			X	X		Distant train horns	55.8	65.5
ST-140	530 W. Floridor Avenue	City of Fresno	R	X		X			X		X		53.9	66.1
ST-141	31793 Riverside Street	City of Shafter	R	X		X			X		X	BNSF Horn in distance	48.1	54
ST-142	16819 N. Shafter Avenue	City of Shafter	R			X		X	X			60Hz buzz from light; oil pump motors	59.2	68.2
ST-143	29577 Poso Drive	City of Shafter	R	X		X	X		X		X	Amtrak Horn	53	62.4
ST-144	Bethel Temple Church (1224 Kern Street)	City of Fresno	I			X	X	X			X		60.9	66.9
ST-145	Buddhist Temple (1129 Tulane)	City of Fresno	I	X		X	X	X			X	Train horn 11:36; Cars running over metal plate and	56.9	61.4
ST-146	La Vena's Educational Center (1015 Fresno Street)	City of Fresno	I			X		X				Construction on building across street	68.4	71.2
ST-147	School ground on Stanislaus Street	City of Fresno	I	X		X			X	X	X		58	59.6
ST-148	Park @ corner of Amador and C Street	City of Fresno	I			X					X		60.1	61.8

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-149	Glory Bound Ministries (916 Waterman @ Kern Street)	City of Fresno	I	X		X	X		X		X	Traffic on Waterman and Kern; Church Bells; UP Train Horn	58.8	61.1
ST-150	Boys and Girls Club (930 Tulare Street @ Mayor)	City of Fresno	I	X		X	X		X		X	Train Horn	57.5	59.3
ST-151	Life Ministries (552 Tuolumne Street)	City of Fresno	I	X		X	X				X	Traffic on Tuolumne, A Street, Snow Ave; F-18's; car horn	65.2	66.7
ST-152	1904 McKenzie	City of Fresno	R	X		X	X		X			Train @ 13:04-13:05, 13:38-13:41	67.3	73.8
ST-153	472 Calaveras	City of Fresno	R	X		X		X			X		59.4	65.7
ST-154	313 Blackstone	City of Fresno	R			X			X				61.5	63.1
ST-155	1225 Divisadero Street @ Poplar Ave	City of Fresno	R	X		X	X	X	X			Traffic on Divisadero St., Poplar Ave; AMTRAK horn in distance; Train horn in distance	62.2	66.1
ST-156	455 Broadway (Broadmont Apartments)	City of Fresno	R			X	X	X				Traffic noise	60.8	64
ST-157	(West of) 282 San Pablo	City of Fresno	R	X		X	X		X		X	AMTRAK horn, UP Horn, Military and general aviation	61.4	63.5
ST-158	1227 Miller Street	City of Bakersfield	R	X		X	X		X		X	Distant sirens heard @ 11:08; aircraft overhead @ 11:14	62.2	70.7

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-159	Bessie Owens Intermediate School (815 Eureka Street @ King Street)	City of Bakersfield	I	X		X					X		55	60.4
ST-160	400 Chico	City of Bakersfield	R	X		X						Sirens, Train horn	56.9	62.8
ST-161	Alpine Street	City of Bakersfield	R	X		X	X		X				61.7	70.4
ST-162	Grace Christian Center (231 Beale Avenue @ Chico	City of Bakersfield	I			X			X	X	X		59.3	64.8
ST-163	Unknown	City of Bakersfield	R			X				X	X		54.6	59.6
ST-164	Our Lady Of Guadalupe Church (601 East California Ave)	City of Bakersfield	I			X		X			X		67.6	73.9
ST-165	Martin Luther King Jr. Memorial Park; California Veteran Memorial Building (Corner of Owens Street & California Ave)	City of Bakersfield	I			X		X		X	X		59	63.2
ST-166	Church (1020 E. California Avenue)	City of Bakersfield	I			X	X				X		59.5	63.7

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-167	Mt. Vernon Elementary School (2162 Potomac Ave, Bakersfield, CA 93307)	City of Bakersfield	I			X				X	X		64.1	68.5
ST-168	Corner of Exchange Street and Steele Avenue	City of Bakersfield	R	X		X					X		59.7	64.1
ST-169	1241 Ogden	City of Bakersfield	R			X	X				X		60.1	70.8
ST-170	Potomac Park	City of Bakersfield	I	X		X			X		X	Train passed @ 15:06; Distant sirens @ 3:26	60.1	66.4
ST-171	Corner of Center Street and Tauchen Street	City of Bakersfield	R	X		X					X		63.4	69.2
ST-172	1008 Webster	City of Bakersfield	R				X				X	Compressor started @ 15:00	61.6	67.4
ST-173	2509 East California	City of Bakersfield	R	X		X			X		X	Train passed location @ 10:03	58.4	65.4
ST-174	2523 Steele Street	City of Bakersfield	R	X		X			X		X		62.7	61.3
ST-175	Lake Street	City of Bakersfield	R	X		X						Train horns	51.3	59.3
ST-176	612 Descano Street	City of Bakersfield	R	X		X			X	X		Trains passed location @ 10:52, 11:18, 11:35	59.5	61.9
ST-177	Ramoa Garza School (2901 Center Street)	City of Bakersfield	I	X		X				X	X		68.8	71.2
ST-178	3201 Edison Hwy	City of Bakersfield	R	X		X			X			A lot of cars; Train passed location @ 10:52-10:55 (EB), 11:00 (WB), 11:20 (EB+WB), 11:35 (WB), 11:36 (EB)	72.8	75.2

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-179	526 Normandy Way (Corner of Normandy and Sterling)	City of Bakersfield	R			X			X		X		62.7	74.1
ST-180	3815 Edison	City of Bakersfield	R			X							66.9	75.2
ST-181	Virginia Avenue School (3301 Virginia Avenue, Bakersfield, CA 93307-2931)	City of Bakersfield	I			X				X		Bell at school rang @ 11:28, 11:43, 11:48, 12:13; Air conditioning unit ran @ 11:40-11:45	59.3	71.3
ST-182	Unitarian Universalist Fellowship (Corner of Deacon Street and Sterling Road)	City of Bakersfield	I			X					X		54	65.9
ST-183	317 Sterling	City of Bakersfield	R	X		X		X				Train 50 feet away	61	72.9
ST-184	Foothill High School (501 Park Drive, Bakersfield, CA 93306-6099)	City of Bakersfield	I	X		X			X		X		52.4	58.1
ST-185	The Church of Jesus Christ of Latter Day Saints (851 Monica Street)	City of Bakersfield	I			X					X		57.3	65.6
ST-186	300 Royal	City of Bakersfield	R	X		X						A lot of traffic at this location	61.1	65.8

Table 4-3
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				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-187	Edison Middle School (721 Edison Road, Bakersfield, CA 93307)	City of Bakersfield	I			X							67.1	76.3
ST-188	415 Monica Street	City of Bakersfield	R						X		X		54.6	63.7
ST-189	532 Pepper	City of Bakersfield	R	X							X		60.9	70
ST-190	Penn Elementary School (2201 San Emidio Street, Bakersfield, CA 93304-1125)	City of Bakersfield	I	X		X			X		X		53.1	63
ST-191	3131 Truxton Avenue - Corner of Oak Street and Truxton Ave	City of Bakersfield	R			X							71.5	75.7
ST-192	3114 Chester Lane	City of Bakersfield	R			X		X					63.6	65.7
ST-193	Beale Park (Corner of Dracena Street and Oleander Avenue)	City of Bakersfield	I			X			X		X		57.2	66.8
ST-194	Church of the Brethren (2471 Palm Street @ A Street)	City of Bakersfield	I			X				X			66.1	67.5
ST-195	1608 E Street	City of Bakersfield	R	X		X	X		X		X		57	59.8
ST-196	Lowell Park (Corner of 4th Street and P Street)	City of Bakersfield	I			X					X		61.2	65.7

Table 4-3
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				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-197	Beale Park (1980 Palm Street)	City of Bakersfield	I			X					X		54.2	56.5
ST-198	10th Street	City of Bakersfield	R			X							61.8	73.4
ST-199	Bakersfield Police Activity League (413 East 3rd Street (Corner or Marsh & 3rd)	City of Bakersfield	I			X				X	X		57.8	60.5
ST-200	John Fremont School	City of Bakersfield	I			X				X	X		56.7	59.4
ST-201	Trinity Methodist Church (Corner of Niles and King Street)	City of Bakersfield	I			X	X				X	Plane overhead @ 11:03	61	62.7
ST-202	1070 Tulare	City of Bakersfield	R	X		X	X				X	Small twin engine plane overhead	55.6	57.2
ST-203	Bastro Park (Corner of Elm Street and 18th Street)	City of Bakersfield	I			X				X	X		61	69
ST-204	2330 Elm Street	City of Bakersfield	R			X	X					A lot of traffic at this location	69.7	69.9
ST-205	1158 Northstar Dr.	City of Hanford	R	X					X		X	Trash truck at 11:39	63.3	70.7
ST-206	1041 Willow Dr.	City of Hanford	R	X					X				55.4	68.9
ST-207	1052 Minaret Pl.	City of Hanford	R	X					X				51.9	68.9
ST-208	1950 Roland Dr.	City of Hanford	R			X			X				46.6	71.1
ST-209	10796 Hume Ave.	City of Hanford	R	X					X				54.4	67.0

Table 4-3
Short-Term Noise Measurement Summary

Site	Address	City	Land Use Activity (Res-Inst.)	Existing Noise Sources								Comments	Measured	Estimated
				Rail	Grade Crossing	Roadway	Aircraft	Industrial/ Commercial	Community/Household	Children Playing	Dogs/Birds		L_{eq} (dBA)	L_{dn} (dBA)
ST-210	1117 Audubon Rd.	City of Hanford	R	X					X				58.1	71.1
ST-211	11125 Doris St.	City of Hanford	R	X					X				62.8	74.0
ST-212	10221 Kansas Ave.	City of Hanford	R	X					X		X	Dogs barking	61.7	76.5
ST-213	10870 Thompson Dr.	City of Hanford	R	X					X		X	Kids driving electric car @ 9:47	52.7	67.0
ST-214	11582 10-1/2 Ave.	City of Hanford	R	X					X			Radio playing	53.6	70.4

Notes:
[1] The L_{eq} (h) and L_{dn} for these LT sites differs by approx. 20 dB, and the short-term measurement was taken during one of the quietest hours of the LT data.

dBA = A-weighted decibels
L_{dn} = day-night sound level, dBA
L_{eq} = equivalent sound level, dBA
ST = short-term

Source: Data provided in tables in this report were compiled by the URS staff listed in Chapter 11.

4.3 Existing Noise Conditions

The area around the proposed station in Fresno is developed primarily with commercial and industrial land uses, with some residential land uses mixed in. The noise environment in this area is dominated by traffic on the local streets, traffic on the freeways that surround the downtown area, and noise from train operations along the Union Pacific Railroad mainline. Noise levels were measured at the noise-sensitive land uses throughout the area, as indicated in Section 4.3, and the measured noise levels ranged from 61 dBA L_{dn} along one of the quieter streets to 72 dBA L_{dn} near the railroad. These noise levels are typical for urban settings dominated by vehicular traffic and railroad operations. The alternative alignment would proceed southeast from the Fresno station, pass State Route 41 and approach the BNSF rail yard. The sensitive land uses in this area are subject to more roadway and railroad noise; the noise levels measured here range from 68 to 75 dBA L_{dn}.

After the alignment passes Jensen Avenue, it turns to the south to follow the BNSF alignment, passing over State Route 99. South of Malaga Street, the alignment runs along the west side of the BNSF right-of-way, between Cedar Avenue to the west and Maple Avenue to the east. The land uses in this area are primarily agricultural, with homes mostly along Cedar Avenue and Maple Avenue. One of the homes adjacent to the existing railroad line experienced a noise level of 79 dBA L_{dn}. This site was dominated by train noise, with a total of 44 trains passing this location in a 24-hour period. Another home farther south that is approximately 900 feet from the existing railroad experienced a noise level of 58 dBA L_{dn}, which is significantly quieter.

From this point, the project alignment follows the BNSF for approximately 12 miles through primarily agricultural lands. Along this portion of the alternative alignments, the measured ambient noise levels ranged from 64 to 77 dBA L_{dn}. These noise levels are to be expected in areas near freight and passenger train operations. The median measured noise level for these same sites without train operations ranged from 36 to 44 dBA L_{dn}; these noise levels are comparable to the inside of a house during a quiet evening.

After crossing Clarkson Avenue, the project alignment turns to the southeast, away from the BNSF right-of-way, to bypass the community of Laton and to run around the east side of Hanford. The land uses in the area continue to be primarily agricultural. The measured ambient noise levels between Laton and State Route 198 ranged from 47 to 63 dBA L_{dn}. These noise levels are consistent with a rural environment with some vehicular traffic. The project alignment runs on the east side of State Route 43 as it turns south toward Corcoran. It runs halfway between 7th Street and 8th Street. The land uses along the alignment between State Route 198 and Corcoran are primarily dairy farms and fields of alfalfa. The measured ambient noise levels in this area range from 52 dBA L_{dn} at the homes away from busy roadways to 72 dBA L_{dn} for the homes adjacent to the main arterials.

Just south of Idaho Avenue, the project alignment curves to the southwest, crosses Highway 43, then curves to the left in order to meet up with the BNSF alignment on the north side of Corcoran. South of Nevada Avenue, the Corcoran Bypass Alternative curves toward the east to bypass Corcoran around the east side. Noise measurements made along the alignment through the City of Corcoran ranged from 64 to 81 dBA L_{dn}. These noise levels are consistent with homes adjacent to commercial and industrial sites that are exposed to highway traffic and railroad operations. Around the east side of Corcoran, noise levels measured at homes away from State Route 43 and other major roads ranged from 48 to 61 dBA L_{dn}.

South of Corcoran, the BNSF Alternative Alignment and the Corcoran Bypass Alternative rejoin at between Avenue 144 and Avenue 136, and runs along the west side of State Route 43. The land use in the area is agricultural, with a mix of orchards, alfalfa, and dairy. The noise levels measured in this area ranged from 59 to 70 dBA L_{dn}. These noise levels are consistent with expectations for homes along a two-lane highway and an active rail line.

In the vicinity of Allensworth, the measured noise levels for the homes near the BNSF right-of-way ranged from 62 to 76 dBA L_{dn}. For homes farther from the tracks, the measured noise levels were from 47 to 63 dBA L_{eq}, levels that would be expected for a reasonably quiet neighborhood. For the homes near both State Route 43 and the BNSF right-of-way, the measured noise levels ranged from 71 to 74 dBA L_{dn}.

South of Avenue 84, Alternative Bypass Alignment curves to the south in order to go around the Allensworth Historic Park and the Pixley Wildlife Refuge to the west. The Allensworth Bypass Alignment rejoins the BNSF Alternative at Whisler Road, just north of the City of Wasco. The Wasco-Shafter Bypass alignment curves to the southeast to avoid the cities of Wasco and Shafter, while the BNSF Alternative goes through the downtown areas of the cities of Wasco and Shafter, following the BNSF right-of-way as much as is practicable. The noise levels measured along the BNSF Alternative alignment through these cities generally ranged from 70 to 79 dBA L_{dn}. These levels are very loud and reflect the proximity to an active freight rail line.

The Wasco-Shafter Bypass Alternative alignment goes through agricultural land and through some of the least-populated areas along the alternative alignment. Noise levels measured along this alternative ranged from 54 to 61 dBA L_{dn}, which are levels to be expected in a quiet, rural environment. For the homes next to the well-traveled roadways, the noise levels ranged from 67 to 71 dBA L_{dn}.

South of Reina Road, the land uses transition from agricultural to residential, with several neighborhoods of single-family dwellings. Along this portion of the alternative alignments, noise measurements were conducted in the rear yards of homes that back up to the existing BNSF right-of-way. The noise levels measured at these homes ranged from 65 to 77 dBA L_{dn}. These levels are very high and are reflective of homes directly adjacent to a busy railroad line. Beyond this point, the BNSF line and the project alternatives turn east toward the freight yard and station at Bakersfield. The land uses here are urban; roadways, freeways, and rail lines dominate the noise environment. The noise measurements conducted near the alternative alignments in this area ranged from 59 to 70 dBA $L_{dn,}$ which are consistent with an urban environment.

4.4 Existing Vibration Environment

4.4.1 Vibration Sensitive Receptors

The vibration sensitive receivers would be similar to the noise-sensitive receivers described in Section 5.1 and listed in Appendix E, except limited to those with sensitive structures within an appropriate screening distance of the alternative HST alignments, as described in Table 4-4.

Table 4-4
Vibration Impact Screening Distances

Land Use	Screening Distance for HST (in feet , from centerline)		
	Up to 100 mph	Up to 200 mph	Up to 300 mph
Residential	120 ft	220 ft	275 ft
Institutional	100 ft	160 ft	220 ft

ft = feet
HST = high-speed train
mph = mile(s) per hour
Source: FRA 2005.

In general, the noise-sensitive receiver locations with structures that are within the limited vibration screening distance would be a small subset of the entire list of noise-sensitive receiver locations.

4.4.2 Measured Vibration Levels

Unlike the FTA/FRA noise impact assessment method, train-related vibration impact thresholds are not dependent on existing ground vibration levels, so the empirical documentation of existing ground vibration levels is not as critical as for noise levels. However, due to the inherent variability of ground propagation characteristics from one location to another, it is helpful to collect train-induced ground vibration level data, where available, to assess whether established general train-related ground vibration prediction methods, such as those provided by FRA impact assessment methods, are sufficiently conservative.

Vibration measurements were conducted at a total of 12 locations that were representative of actual potentially impacted areas that were within 220 feet of a HST alternative alignment and within approximately 250 feet of an existing active rail line. The field vibration data was processed in an appropriate fashion for comparison to established FTA/FRA impact criteria (i.e., maximum event vibration level) and then compared to the value generated by the FTA general vibration assessment procedure (using the Generalized Ground Surface Vibration Curve for "locomotive powered passenger or freight"). The values calculated using this FTA method are described as representing the "upper range of measurement data for a well maintained system" so it is expected that the majority of the field measurements collected for this project would be at or below the FTA predicted value.

A summary of the vibration measurements is presented in Table 4-5, including measured vibration levels for various train-related vibration events and a comparison to predicted values using the FTA prediction method. Additional detail regarding the field vibration measurements, including a sample of the field documentation procedures, is presented in Appendix E.

Table 4-5
Measured Vibration Levels

Location ID/Description/Address		Start Time (hh:mm)	Event Description	Distance to Tracks (feet)	Measured Maximum Vibration Velocity (VdB)	Measured re. Residential Standard (72 VdB)
V-01	11901 Snowberry Lane, Bakersfield, CA, 93312; Accelerometer @ NE Corner of the house ~65" from rails	15:19	BNSF Freight Eastbound	65 ft	83.6	11.6
		15:58	BNSF GT Eastbound		75.6	3.6
		16:18	BNSF GT Westbound		82.2	10.2
		16:46	BNSF DS Eastbound		78.1	6.1
V-02	10430 Glenn Street, Green Acres, CA, 93312; Accelerometer @ SW corner of the house ~92' from rails	10:17	Amtrak Westbound	92 ft	91.7	19.7
		10:28	BNSF Westbound		77.3	5.3
		11:37	BNSF Eastbound		76.5	4.5
		11:40	Amtrak Eastbound		70.8	-1.2
		11:58	BNSF Westbound		79.1	7.1
V-03	2500 Jewetta Ave #27, Bakersfield, CA 93312; Accelerometer @ SE corner of yard ~60' from rails	11:09	BNSF Westbound	60 ft	81.8	9.8
		12:31	Amtrak and BNSF		80.5	8.5
		13:06	BNSF		81.2	9.2
		13:29	Amtrak (2) w/ MC		74.6	2.6
		14:28	BNSF Eastbound		78.4	6.4
		15:16	Amtrak		74.7	2.7
		15:55	Amtrak		71.2	-0.8
V-04	11501 Mockingbird Court, Bakersfield, CA, 93312; Accelerometer @ NE corner of garage ~105'-110' from rails	11:43	Amtrak EB 1/6	105–110 ft	64.5	-7.5
		12:24	BNSF Engines 2/0		66.2	-5.8
		12:45	BNSF Freight Eastbound 3/28/2		67.3	-4.7
		12:52	BNSF DS Westbound 4/98/0		76.0	4
V-05	12013 Compass Avenue, Bakersfield, CA, 93312; Accelerometer @ SW corner of patio ~70' from rails	10:00	Amtrak Westbound	70 ft	75.6	3.6
		10:20	BNSF Eastbound		69.7	-2.3
		10:39	BNSF Westbound		74.9	2.9
		10:48	BNSF Westbound		75.2	3.2
		11:03	Amtrak Eastbound		77.2	5.2

Table 4-5
Measured Vibration Levels

Location ID/Description/Address		Start Time (hh:mm)	Event Description	Distance to Tracks (feet)	Measured Maximum Vibration Velocity (VdB)	Measured re. Residential Standard (72 VdB)
V-06	8611 Ave. 32, Earlimart, CA 93219; Accelerometer @ N of structure ~75' from rails	11:08	Amtrak EB 1/4	75 ft	68.6	-3.4
		12:07	BNSF EB 4/ /2		81.9	9.9
		16:31	BNSF EB 4/		71.2	-0.8
V-07	417 Dolores Street, Bakersfield, CA 93305; Accelerometer @ N corner of structure ~165' from rails	8:47	BNSF - WB 2/117 TOFC Empty @ 25 mph	165 ft	78.0	6
		10:26	BNSF - EB 75/2 Tank Cars @ 25 mph		69.6	-2.4
		12:05	AMBIENT		60.8	-11.2
V-08	721 Oswell Street, Bakersfield, CA 93306; Accelerometer @ SE corner of #20 ~93' from rails	13:15	BNSF - EB Mixed 4/88/2 @ 45mph	93 ft	74.3	2.3
		15:31	AMBIENT		69.1	-2.9
V-09	250 Fairfax Road Site 320, Bakersfield Palms RV Park, Bakersfield, CA 93307; Accelerometer ~163' from rails	9:51	UP - WB DS /92/1 @ 35-45 mph	163	59.1	-12.9
V-10	2264 N. Heron Place, Hanford, CA 93230; Accelerometer @ SW corner of the patio ~108' from rails	14:40	Amtrak EB 4/1 @ 45 mph	108	82.8	10.8
		14:47	Amtrak WB 1/4 @ 45 mph	108	85.6	13.6
		15:15	BNSF - EB Mixed 3/55/2 @ 45mph	108	94.9	22.9
		15:26	BNSF - EB Grain 3/108 @ 45mph	108	87.6	15.6
		15:48	BNSF - EB Mixed 3/95/2 @ 45mph	108	96	24
		17:11	Amtrak WB 1/4 @ 45 mph	108	78.5	6.5
		17:15	BNSF - EB Mixed 3/88/2 @ 45mph	108	82.7	10.7
		17:45	BNSF - EB Mixed 3/103/2 @ 30mph	108	80.3	8.3
		17:52	Amtrak EB 4/1 @ 50 mph	108	81.4	9.4
		18:05	BNSF - EB Mixed 2/3 @ 45mph	108	85.3	13.3

Table 4-5
Measured Vibration Levels

Location ID/Description/Address		Start Time (hh:mm)	Event Description	Distance to Tracks (feet)	Measured Maximum Vibration Velocity (VdB)	Measured re. Residential Standard (72 VdB)
V-11	1158 W. Northstar Dr., Hanford, CA 93230; Accelerometer @ N of structure ~166' from rails	14:40	Amtrak EB 4/1 @ 45 mph	166	79.8	7.8
		14:47	Amtrak WB 1/4 @ 45 mph	166	78.1	6.1
		15:15	BNSF - EB Mixed 3/55/2 @ 45mph	166	84.9	12.9
		15:26	BNSF - EB Grain 3/108 @ 45mph	166	79.4	7.4
		15:48	BNSF - EB Mixed 3/95/2 @ 45mph	166	78.4	6.4
		17:11	Amtrak WB 1/4 @ 45 mph	166	77.7	5.7
		17:15	BNSF - EB Mixed 3/88/2 @ 45mph	166	80.7	8.7
		17:45	BNSF - EB Mixed 3/103/2 @ 30mph	166	83.4	11.4
		17:52	Amtrak EB 4/1 @ 50 mph	166	73.1	1.1
		18:05	BNSF - EB Mixed 2/3 @ 45mph	166	77.5	5.5
		18:05	BNSF - EB Mixed 2/3 @ 45mph	166	77.9	5.9
V-12	2098 N. Heron Place, Hanford, CA 93230; Accelerometer @ NW corner of house ~183' from rails	10:00	BNSF - WB DS/TOFC 4/105 @ 45 mph	183	74	2
		10:20	BNSF - EB 3 @ 45 mph	183	69	-3
		10:39	BNSF - WB Mixed 5/86 @ 45 mph	183	79.5	7.5
		10:48	BNSF - WB Auto Racks 3/71 @ 40 mph	183	73	1
		11:03	Amtrak WB 1/4 @ 45 mph	183	65.9	-6.1

Source: Data provided in tables in this report were compiled by the URS staff listed in Chapter 11.
Notes:
BNSF = Burlington Northern Santa Fe, UP = Union Pacific, SJVR = San Joaquin Valley Railroad
EB = Eastbound, WB = Westbound,
GT = grain train, DS = double stack, TOFC = trailer on flat car, MC = motorcycle
mph = miles per hour
VdB = RMS Vibration Velocity Level, dB
x / y / z = number of x locos, y cars, z locos

Table 4-5 shows measured vibration levels to generally be equal to or less than the levels predicted by the (conservative) FTA method (generally within about 0 to -8 VdB). Two of the nine measured locations (Vib-02 and Vib-07) displayed some vibration levels higher than those predicted by the FTA method. The apparently efficient vibration propagation characteristics at these two locations were taken into account during the impact assessment. Several events were more than 10 VdB lower than the predicted values. This may have been due to either less efficient soil propagation characterizations at these locations, or simply lower-than-predicted isolated events. The predicted levels included the expectation of flat spots on the wheels which are common on mixed freight trains, and much less so on Amtrak trains. Perhaps the lower levels are due to lower actual train speeds than estimated in the field.

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Section 5.0

Noise and Vibration Prediction Methodology

5.0 Project Noise and Vibration Prediction Methodology

5.1 Categories of High-Speed Trains

The noise and vibration assessment presented in this report follows the methods and procedures established by Federal Railroad Administration (FRA) policy as specified in the FRA policy document *High- Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2005). FRA guidelines are utilized when determining the impacts of high-speed train noise on various types of noise-sensitive receivers that range from livestock and wildlife to human receptors at residential land uses. For impact criteria from high-speed train noise, the FRA uses a sliding scale that can be found in Figures 3-3 and 3-4 of this report.

There are three major sources of noise from the train that need to be taken into account when predicting future noise levels as a result of the HST project at noise-sensitive receivers. "High-speed" trains are categorized into three subcategories:

- "high-speed," with a maximum speed of 150 mph.
- "very high-speed," with a maximum speed of 250 mph.
- "maglev," magnetically levitated and powered systems representing the upper range of speed performance up to 300 mph.

The current HST project falls into the "very high-speed" train category because the speed of the steel-wheeled trains will increase up to 220 mph.

5.2 High-Speed Train Noise Prediction Components

In order to predict noise levels at noise-sensitive receivers as a result of existing conditions plus proposed HST project conditions, noise source reference levels, HST project operating conditions, propagation paths and distances, and total noise exposure all need to be assessed. There are several alignment options that are being considered for the HST project. Each one will have different noise and vibration effects on the surrounding environs and the noise-sensitive receivers nearby. Before any predictions can be made regarding noise levels as a result of the HST project, noise-sensitive receivers need to be identified and existing noise exposure at these noise-sensitive receivers need to be quantified. Section 4 of this report identified potentially impacted noise-sensitive receivers and existing noise conditions.

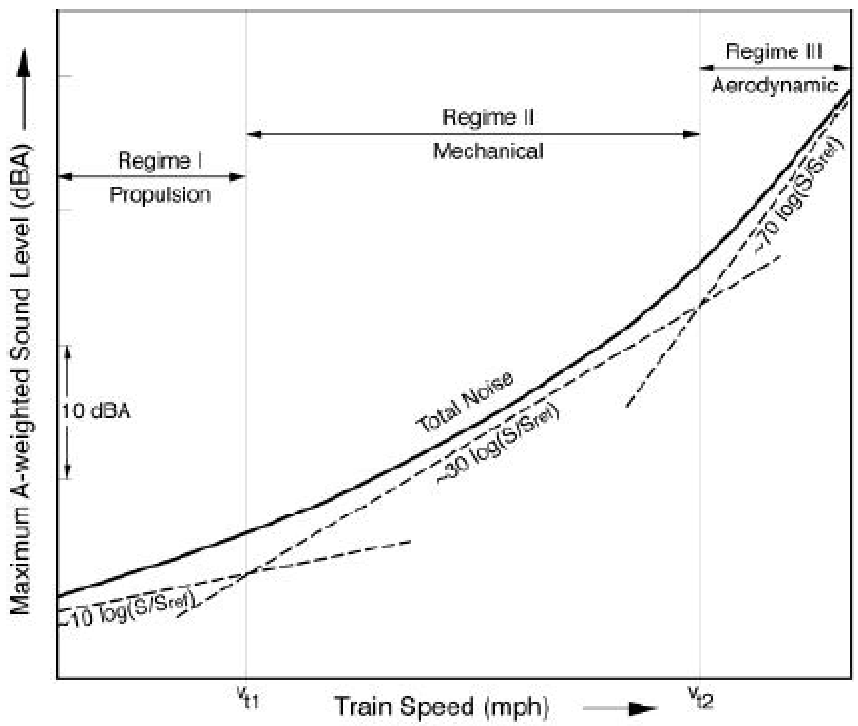
5.2.1 Sources of High-Speed Train Noise

There are three individual noise mechanisms that generate noise levels at a nearby noise-sensitive receiver as the train passes by. The three mechanisms are all dependent on source location, noise level, frequency content, directivity, and speed. These three mechanisms are:

- Regime I. propulsion or machinery noise,
- Regime II. mechanical noise resulting from wheel/rail interactions and/or guideway vibrations, and
- Regime III. Aerodynamic noise resulting from airflow moving past the train.

There are three different regimes involved in predicting noise levels because certain regimes dominate the overall noise level depending on the previously mentioned noise components and the speed of the train. For steel-wheeled trains, low speeds are dominated by mechanical noise sources that are involved with the propulsion of the train (Regime I). Internal cooling fans are located near the power units at approximately 10 feet above the rails and dominate noise levels around the frequency spectrum near 1000 Hz when the train is in motion while external cooling fans dominate the total noise level when the train is stopped at a station. Wheel interactions with the railway define Regime II. Noise is generated when the steel wheels roll along the rail. A majority of the noise falls into the frequency spectrum that ranges from 2 kHz to 4 kHz. A majority of the vibratory effects from high-speed trains result from these interactions. Wheel-rail interactions tend to dominate the A-Weighted overall noise levels up to about 160 mph. After the train reaches above 160 mph, aerodynamic noise (Regime III) begins to become a critical part of the overall noise level. Significant contributions to the overall noise level from aerodynamic noise begin at 180 mph. Noise is generated by the airflow around the train. Discontinuities in the surface along the length of the train and inter-coach gaps are a couple of the structural components that contribute to aerodynamic noise.

Figure 5-1 illustrates the generalized sound level dependence on speed for the three Regimes. V_t represents the speed of the train where the dominant train noise source transitions to another dominant train noise source. V_{t1} is the speed where the dominant noise source transitions from propulsion to wheel-rail interaction. V_{t2} is the speed where the dominant noise source transitions from wheel-rail interaction to aerodynamic noise.



Source: FRA 2005

Figure 5-1
Regime sound level dependence on speed

The reference SEL, length, and speed relationship for each noise subsource generated by the train is then used to find the total noise level that is propagating from the train. The source reference level is referenced to a given distance. Generalized noise levels will need to be established for each subsource under a fixed set of operating conditions. Table 5-1 lists five different types of systems that are commonly used for determining sound levels generated by high-speed trains. The reference SEL for each subsource is given at a reference distance of 50 feet from the centerline of the proposed track alignment. The SEL levels in Table 5-1 originate from background measurement and research programs that examined noise levels from different high-speed trains throughout the world.

Table 5-1
Source Reference SELs at 50 feet

System Category and Features[a]	Example Systems	Subsource Component	Subsource Parameters		Reference Quantities			
			Length Definition, len	Height Above Rails (ft)	SEL_{ref} (dBA)	len_{ref} (ft)	S_{ref} (mph)	K
HS EMU • *Steel-Wheeled* • *High-Speed* • *Electric Multiple Units (EMU)*	Pendolino IC-T	Propulsion	len_{power}	10	86	73	20	1
		Wheel-rail	len_{train}	1	91	634	90	20
VHS ELECTRIC • *Steel-Wheeled* • *Very High-Speed* • *Locomotive-Hauled* • *Electric Power*	TGV Eurostar ICE Shinkansen	Propulsion	len_{power}	12	86	73	20	0
		Wheel-rail	len_{train}	1	91	634	90	20
		AERO: Train Nose	len_{power}	10	89	73	180	60
		AERO: Wheel Region	len_{train}	5	89	634	180	60
		AERO: Pantograph	[b]	15	86	-	180	60

[a] *HS* (High-Speed) = maximum speed 150 mph
VHS (Very High-Speed) = maximum speed 250 mph
MAGLEV = maximum speed 300 mph

[b] originates as a point source (no length)

[c] Turbulent Boundary Layer

Source: FRA 2005.

For this HST project, the propulsion and wheel-rail source noise levels will come from the HS EMU components found in Table 5-1. For the aerodynamic noise, the VHS Electric components will be used in order to predict HST project noise levels.

5.2.2 Project Operating Conditions

HST project operating conditions are important in determining peak hour noise levels, hourly L_{eq} values and L_{dn}/CNEL values at noise-sensitive receivers. The values from Table 5-1 are used only as reference values in helping to determine the predicted HST project SEL values. Once the appropriate system category and reference quantities are established, the following input parameters are required to adjust each reference SEL to the appropriate HST project operating conditions:

- number of passenger cars in the train, N_{cars},
- number of power units in the trains, N_{power},
- length of one passenger car, $ulen_{car}$,
- length of one power unit, $ulen_{power}$, and
- train speed in miles per hours, S.

The following equation should be used to adjust each "*n*th" subsource SEL to the HST project operating conditions identified above:

$$SEL_n = \left(SEL_{ref}\right)_n + 10\log\left(\frac{len}{len_{ref}}\right) + K\log\left(\frac{S}{S_{ref}}\right)_n$$

The consist adjustment in the above equation is reflected in the "10 log(len/len_{ref})" term, where *len* represents the subsource length (len_{power}, len_{train}) specified in Table 5-1. These variables are defined as:

$$len_{power} = N_{power} \times ulen_{power},$$

and

$$len_{train} = \left(N_{power} \times ulen_{power}\right) + \left(N_{cars} \times ulen_{car}\right).$$

The speed adjustment is given by the "K log(S/S_{ref})" term, using the appropriate value for K in Table 5-1.

5.2.3 Propagation of Noise to Receivers

The propagation of noise from the three high-speed train subsources depends on several key components that pertain to the specific noise exposure-versus-distance relationship. The propagation characteristics between each subsource and each receiver need to be determined. Using these characteristics, an SEL-distance relationship for each subsource can be made. Final adjustments are then made to the SEL-distance relationship due to terrain, shielding, or any other propagation path intervening features.

The distance between each subsource on the high-speed train and noise-sensitive receivers have a unique relationship pertaining to how the noise levels attenuate over a given distance. Sound levels naturally attenuate over distance. Figure 5-2 shows the attenuation over distance for both point sources and line sources from a high-speed train. For point sources, noise levels are attenuated by 6 dB per doubling of distance. Each subsource on the high-speed train radiates individually as a point source. Most of the individual subsources on the train are arranged in a linear arrangement and act as line sources. Noise levels from line sources attenuate by 3 dB per doubling of distance for L_{eq} and L_{dn} values and 3 to 6 dB per doubling of distance for L_{max} values. The amount of attenuation for L_{max} values is dependent upon the length of the train. Once the distance from the noise source to the noise-sensitive receiver is equal to that of the length of the train, the L_{max} values attenuate by 6 dB per doubling of distance. This is illustrated in Figure 5-2.

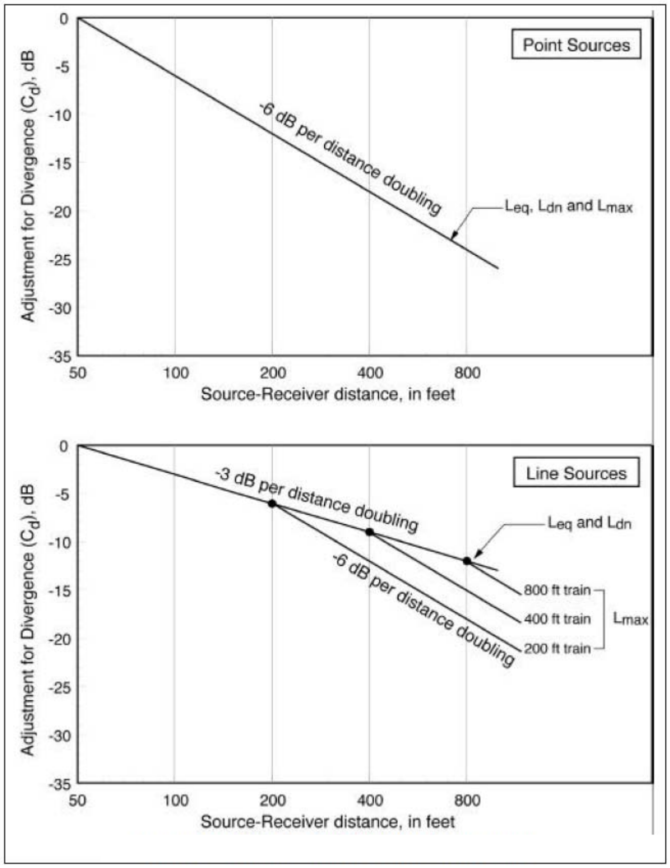
The cross-section geometry between the subsource and the receiver is a very significant aspect in determining the SEL-distance relationship. More attenuation due to ground absorption will occur as the distance between the subsource and receiver increases. The heights of both the receivers and the subsources, and their relation to each other and the ground, are all relevant to the propagation path and SEL-distance relationship. The amount of attenuation due to ground absorption from subsource to noise-sensitive receiver is dependent upon the direct line of sight from one to the other and the average height between the two. As the average height decreases, the ground will absorb more noise generated by propulsion subsources and wheel-rail interaction. Ground absorption does little to attenuate aerodynamic noise. The following equations are examples of how to determine the effect of ground attenuation on the noise propagation path. H_{eff} represents the average path height between the subsource and the noise-sensitive receiver. G represents the ground factor. For hard ground, there is no noise attenuation due to ground absorption.

For soft ground:

$$G = \begin{cases} 0.66 & H_{eff} < 5 \\ 0.75\left(1 - \frac{H_{eff}}{42}\right) & 5 < H_{eff} < 42 \\ 0 & H_{eff} > 42 \end{cases}$$

For hard ground:

$$G = 0$$



Source: FRA 2005

Figure 5-2
Attenuation due to distance (divergence)

Shielding due to terrain and the introduction of noise barriers are two important components in determining the propagation of noise to noise-sensitive receivers. If there is line of sight from a subsource on the high-speed train to a noise-sensitive receiver, the ground factor becomes more critical in determining the amount of attenuation over a given distance. Once line of sight is broken, additional attenuation will be accrued. Line of sight may be broken due to intervening noise barriers and uneven terrain features in the natural topography and this allows for shielding along the noise propagation path.

An SEL versus distance relationship can be established for the three types of subsources from the high-speed train. Using the distance from the each subsource to the noise-sensitive receiver and the amount of ground absorption and attenuation provided by intervening noise barriers and shielding due to natural topography, the total noise exposure at specific noise-sensitive receivers can be determined as a result of the HST project.

5.2.4 Benchmark Test to Validate Noise Prediction Modeling

In order to calculate the future noise level from proposed HST operations, the noise parameters and equations within the protocol (FRA 2005) needed to be compiled into a useable coded noise model. During the development of the noise model, the environmental program manager for the HST Authority distributed a series of input parameters and output results against which the noise model could be compared for accuracy. The input parameters included operational assumptions (length of train, number of trains during daytime and nighttime hours, train speed) as well as a range of site conditions (height of source, height of receiver, distance to receiver). The results of our analysis were compared to the sample results provided, and the results of these comparisons are presented in Tables 5-2 and 5-3.

5.2.5 Cumulative Noise Exposure

In order to establish the cumulative noise exposure at noise-sensitive receivers, all subsource SEL values need to be combined to form a total SEL value for a single train passby. Operating schedules are critical to the cumulative noise exposure at noise-sensitive receivers. The total SEL value, total number of train passbys and the time of day that the passbys will occur all determine the cumulative noise exposure. Noise-sensitive hours provide different weightings for noise levels at different times during the day and night. Cumulative noise exposure is modeled at residential noise-sensitive receivers by the noise measurement matrix L_{dn} because municipal codes and general plans use L_{dn} values to define noise level standards at residential land uses over a 24-hour period. Projected hourly L_{eq} values will also be calculated at other land uses that include, among other uses, churches, schools and libraries. L_{dn} values will not be useful at these locations because these noise-sensitive land uses are not in use 24 hours a day. Peak hour L_{eq} values will be estimated in order to produce a worst-case scenario at non-residential noise-sensitive land uses.

Table 5-2
Comparison of Modeled Results to Reference Results at 100 MPH

100 mph Results and model input parameters using HS EMU							Reference Results			Modeled Results		
Test Case	Receiver Height	Floor of Building	Receiver to Near Track Distance	Source Ground Height (height added to each subsource height in Table 5-2)	Modeled Barrier Height, h(b)	Barrier to Near Track Distance	Ldn	Peak Hr Leq	Lmax	Ldn	Peak Hr Leq	Lmax
Case 1	5-feet	1st floor	100	4-feet	4-feet	6-feet	69.3	69.4	86.7	69.3	69.5	86.0
Case 1	5-feet	1st floor	200	4-feet	4-feet	6-feet	64.9	65.0	79.2	65.1	65.3	79.1
Case 1	5-feet	1st floor	400	4-feet	4-feet	6-feet	60.4	60.5	71.7	60.8	60.9	72.0
Case 1	25-feet	3rd floor	100	4-feet	4-feet	6-feet	70.2	70.3	87.6	70.3	70.5	87.9
Case 1	25-feet	3rd floor	200	4-feet	4-feet	6-feet	66.3	66.5	80.7	66.6	66.8	81.1
Case 1	25-feet	3rd floor	400	4-feet	4-feet	6-feet	62.4	62.5	73.7	62.8	63.0	74.3
Case 2	5-feet	1st floor	100	4-feet	12-feet	21.5-feet	68.2	68.3	87.4	67.7	67.8	86.9
Case 2	5-feet	1st floor	200	4-feet	12-feet	21.5-feet	64.7	64.8	80.4	63.9	64.1	79.6
Case 2	25-feet	3rd floor	100	4-feet	12-feet	21.5-feet	70.3	70.4	88.4	69.7	69.8	87.9
Case 2	25-feet	3rd floor	200	4-feet	12-feet	21.5-feet	66.3	66.4	81.9	65.6	65.5	81.1
Case 3	5-feet	1st floor	200	60-feet	63-feet	15.5-feet	66.2	66.4	83.5	64.9	65.0	82.1
Case 3	25-feet	3rd floor	200	60-feet	63-feet	15.5-feet	67.8	67.9	83.5	67.8	68.0	83.5
Case 4	5-feet	1st floor	200	60-feet	67-feet	15.5-feet	61.0	61.1	78.7	59.8	60.0	77.5
Case 4	25-feet	3rd floor	200	60-feet	67-feet	15.5-feet	65.3	65.5	83.0	65.4	65.5	83.0

Table 5-3
Comparison of Modeled Results to Reference Results at 200 MPH

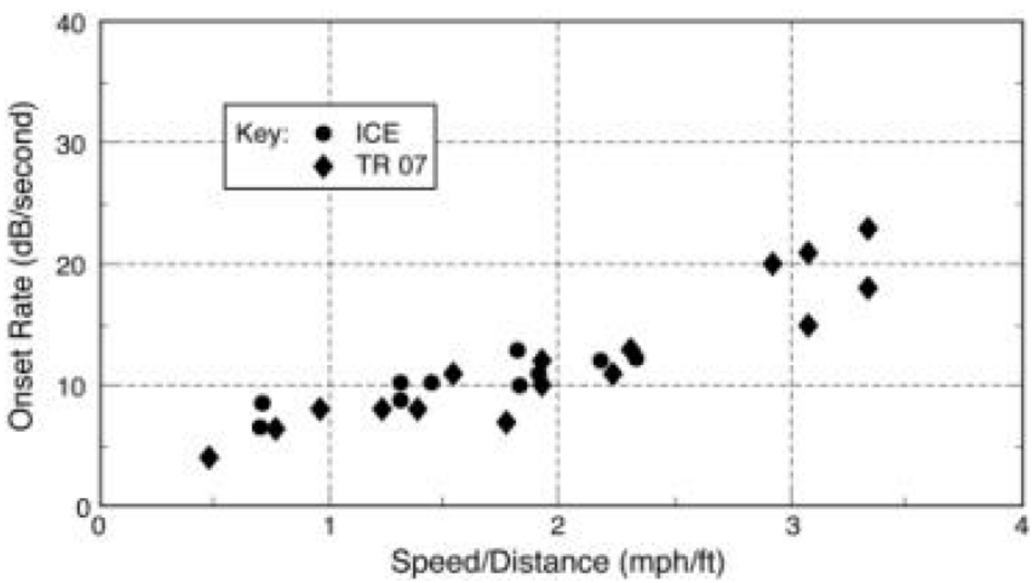
200 mph Results and model input parameters using VHS Electric							Reference Results			Modeled Results		
Test Case	Receiver Height	Floor of Building	Receiver to Near Track Distance	Source Ground Height (height added to each subsource height in Table 5-2)	Modeled Barrier Height, h(b)	Barrier to Near Track Distance	Ldn	Peak Hr Leq	Lmax	Ldn	Peak Hr Leq	Lmax
Case 1	5-feet	1st floor	100	4-feet	4-feet	6-feet	74.0	74.2	89.3	73.5	73.6	89.3
Case 1	5-feet	1st floor	200	4-feet	4-feet	6-feet	70.3	70.4	84.2	69.6	69.8	83.2
Case 1	5-feet	1st floor	400	4-feet	4-feet	6-feet	66.6	66.7	78.3	65.8	65.9	77.7
Case 1	25-feet	3rd floor	100	4-feet	4-feet	6-feet	74.6	74.7	90.0	74.2	74.3	91.2
Case 1	25-feet	3rd floor	200	4-feet	4-feet	6-feet	71.0	71.2	85.4	70.6	70.8	84.4
Case 1	25-feet	3rd floor	400	4-feet	4-feet	6-feet	67.5	67.6	80.1	67.0	67.2	77.6
Case 2	5-feet	1st floor	100	4-feet	12-feet	21.5-feet	71.3	71.4	89.8	71.1	71.2	90.2
Case 2	5-feet	1st floor	200	4-feet	12-feet	21.5-feet	68.3	68.5	82.7	67.8	67.9	82.9
Case 2	25-feet	3rd floor	100	4-feet	12-feet	21.5-feet	73.9	74.0	89.2	73.1	73.3	91.2
Case 2	25-feet	3rd floor	200	4-feet	12-feet	21.5-feet	69.6	69.7	84.2	68.7	68.9	84.4
Case 3	5-feet	1st floor	200	60-feet	63-feet	15.5-feet	68.7	68.8	85.8	68.0	68.1	85.4
Case 3	25-feet	3rd floor	200	60-feet	63-feet	15.5-feet	70.0	70.1	85.8	70.0	70.1	86.8
Case 4	5-feet	1st floor	200	60-feet	67-feet	15.5-feet	65.2	65.4	81.0	64.9	65.0	80.8
Case 4	25-feet	3rd floor	200	60-feet	67-feet	15.5-feet	67.8	67.9	85.4	68.1	68.3	86.4

All high-speed train subsource noise levels, operating schedules and the propagation paths of noise from sub-sources to individual noise-sensitive receivers factor into the prediction of noise levels at all noise-sensitive receivers as a result of the project.

5.3 Annoyance and Startle Effects Due to Rapid Onset Rates

Rapid onset rates due to train noise may cause annoyance and startle effects at human and wildlife noise-sensitive receivers. With very high onset rates, noise-sensitive receivers tend to be startled, or surprised, by the sudden approaching sound. The onset rate is defined as the average rate of change of increasing sound pressure level in decibels per second (dB/sec) during a single noise event. The duration of such an event is short in duration. For this HST project, a single noise event will be a single train passby. As a high-speed train approaches a noise-sensitive receiver located nearby, the noise levels will suddenly increase. This sudden onset rate of noise can cause startle responses at noise-sensitive receivers.

In 1992, the US Air Force studied aircraft noise annoyance and startle response. The FRA uses the completed research to develop a distance vs. level chart for which startle effects can occur. Figure 5-3 represents the collected data by the US Air Force. The X-axis is calculated by dividing the speed of the high-speed train by the distance to the receiver. The Y-axis is the onset rate with that speed-distance relationship. The "ICE" points are measured steel-wheeled high-speed train events and "TR 07" points are measured maglev train events. Figure 5-3 shows that onset rates at noise-sensitive receivers will increase as speeds increase and onset rates will increase as the distance between the train and noise-sensitive receiver is reduced. Figure 5-3 shows that for a given distance, onset rates will increase at noise-sensitive receivers as the speed of the train increases. For a given speed, onset rates will decrease as the distances from the trains to the noise-sensitive receivers decrease.

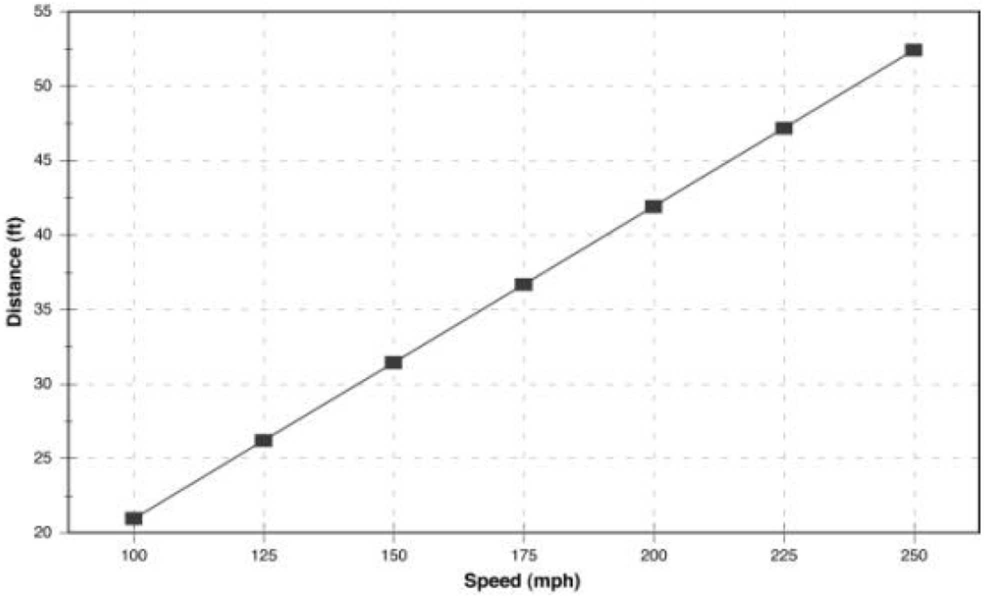


Source: FRA 2005

Figure 5-3
Measured high-speed rail onset rates

Figure 5-4 illustrates the distance vs. speed relationship for rapid onset rates. The distance (in feet) represents the distance at which a startle response can occur at a human noise-sensitive receiver if the area being analyzed is open flat terrain with an unobstructed view of the tracks.

There is no adopted onset rate at which wildlife will be annoyed by high-speed trains.



Source: FRA 2005.

Figure 5-4
Distance from tracks within which startle can occur for HST

An actual observable response from the species in question is necessary in order to make an accurate estimation of annoyance and startle responses. The noise exposure limit for each type of animal is an SEL of 100 dBA from passing trains. The SEL represents a receiver's cumulative noise exposure from an event and represents the total A-weighted sound during the event normalized to a 1-second interval. A screening assessment determined typical and maximum distances from the HST tracks at which this limit may be exceeded.

Project analysts computed train pass-by SEL's for two conditions: at-grade and on a 60-foot-high elevated guideway. To provide a conservative estimate, in each case the HST maximum operating speed of 220 mph was used, and no shielding from intervening structures or terrain was assumed. Along at-grade sections, the screening distance for a single-train pass-by SEL of 100 dBA would be approximately 100 feet from the track centerline. In elevated guideway locations, a single-train pass-by SEL of 100 dBA would not occur beyond the edge of the structure, approximately 15 feet from the track centerline. This assumes the presence of a safety barrier on the edge of the guideways that is 3 feet above the top of the rail height.

For reference, the screening distances for potential wildlife impacts from freight trains that currently use the UPRR and BNSF tracks were determined. The distance to an impact for a freight train is 75 feet when the warning horn is not sounded and 400 feet when the crossing is at–grade and the horn is sounded. These screening distances assume a freight train consisting of 2 locomotives and 100 railcars traveling at 50 mph, which is typical for trains on the UPRR and BNSF tracks. With this screening distance information wildlife might be within the screening distance for an at-grade HST. Because fences control access to the right-of-way and the right-of-way would be 100 feet wide in rural locations, wildlife and domestic animals would have to be within approximately 50 feet of the edge of the right-of-way to experience noise effects above the recommended threshold. The primary location where this could be an issue is where wildlife migration routes cross the HST right-of-way along at-grade locations. At locations adjacent to the UPRR, BNSF, or SR 99 where the existing noise is already high, there would be no impacts. However, in rural areas there could be impacts.

5.4 Noise Impacts on Wildlife Noise-Sensitive Receivers

The impact of noise on wildlife involves a number of parameters, but one of the most apparent is the potential for masking of communication. Wildlife depends on calls and song for species identification, mate attraction, and territorial defense. Hearing in all forms of wildlife is not analogous to hearing in mammals. For example, birds show a high degree of frequency selectivity and vocalize in a much higher frequency range than most traffic noise produces.

Studies have evaluated the potential for masking of bird song by traffic noise and recommended that continuous noise levels above 60 dBA L_{eq} within habitat areas may affect the suitability of habitat use (SANDAG 1988). Many regulatory agencies recommend the use of 60 dBA L_{eq} hourly levels to be considered an impact at the edge of suitable habitat.

Recent research has indicated that SEL values at wildlife noise-sensitive receivers are a very useful indicator of what type of response to expect from specific types of wildlife. Table 3-1 of this report lists 100 dBA SEL for all domestic and wild birds and mammals as an effective criterion level for determining impacts as the result of a train pass-by. All domestic and wild birds and mammals located near the HST project railway corridor may be affected by train pass-bys if they are subjected to SEL values of 100 dBA or higher.

It is possible that some animals may become habituated to higher noise levels and will exhibit reduced response to noise after prior exposure. There is no developed general criterion level or threshold for habituation.

Wildlife responses to noise are species-dependent. Their responses to noise are dependent upon the same components as any other noise-sensitive receiver, but each animal's responses and thresholds are unique enough that noise standards cannot be established. The duration of the noise, type of noise, and level of existing ambient noise weigh differently upon what type of response to expect from individual species.

5.5 Heavy Maintenance Facility

The FTA Transit Noise and Vibration Impact Assessment Manual establishes screening distances for maintenance and parking facilities. A heavy maintenance facility is proposed to be built at one of five locations along the HST project corridor that will run from Fresno to Bakersfield. There will be a parking lot located at the facility. A General Noise Assessment can only be made because the operations at the maintenance facility have not been defined at this time.

Some of the major noise sources at the facility will include signal horns, PA systems, impact tools, vehicle activity ranging from locomotive/rail car passbys and squealing on tight curves to locomotives idling, and other site specific activities. It is difficult to estimate future noise levels at nearby noise-sensitive receivers as a result of the proposed operations at the facility because future operations have not been established. There are noise-sensitive receivers located near all five of the proposed heavy maintenance facilities. The parking areas at each proposed location have not been established at this time.

The first of the five proposed maintenance facilities is located on the southeast side of Fresno. The proposed facility location is in the vicinity of the intersections of S. Cedar Avenue and South

Parkway Drive on the northwest side of the facility and South Maple Avenue and East Adams Avenue on the southeast side of the facility. The second of the five proposed maintenance facility locations is located on the southeast side of Hanford. The proposed facility location is in the vicinity of the intersections of Houston Avenue and Central Valley Highway on the northwest side of the facility and 7th Avenue and Idaho Avenue on the southeast side of the facility. The third proposed maintenance facility location is on the east side of Wasco. The site is bordered by Highway 46 to the north, J Street to the west, and Filburn Avenue to the south. The east boundary of the facility would be about one-half mile west of Root Avenue. The fourth of the five proposed facility locations is located northwest of Bakersfield and southeast of Shafter. The proposed facility location is in the vicinity of the intersections of Burbank Street and Mendota Street on the northwest side of the facility and Nord Avenue and Fanucchi Way on the southeast side of the facility. The last of the five proposed facility locations is located northwest of Bakersfield and southeast of Shafter. The proposed facility location is in the vicinity of the intersections of Burbank Street and Mendosa Street on the northwest side of the facility and Petrol Road and Weidenbach Street on the southeast side of the facility.

5.6 High-Speed Train Detailed Vibration Assessment

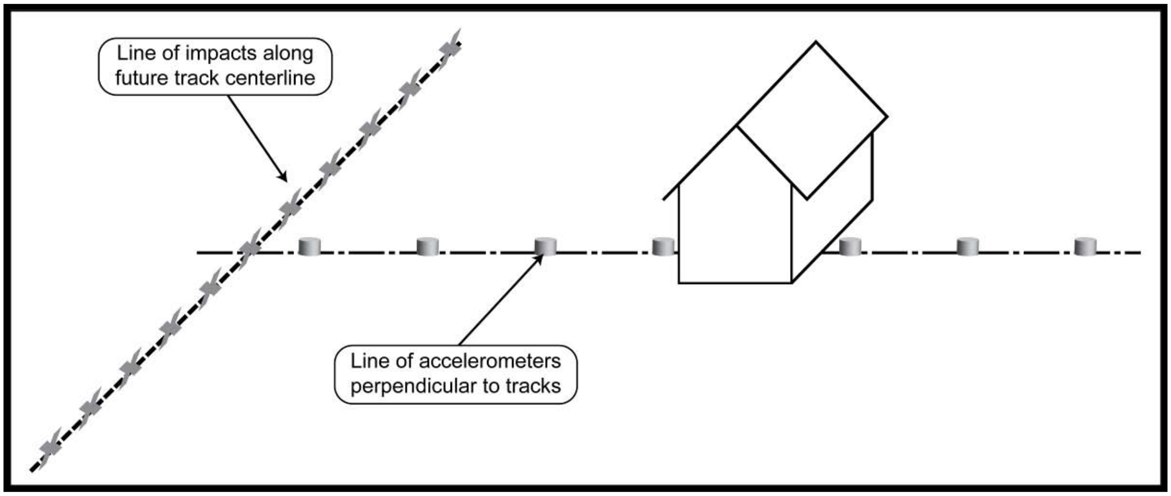
After an FRA General Vibration Assessment has been completed, an FRA Detailed Vibration Assessment follows. The FRA General Vibration Assessment establishes screening distances (or impact zones), and an FRA Detailed Vibration Assessment is designed to develop specific vibration projections from the high-speed train at sensitive buildings where no existing railway corridors are present in the surrounding environment. Once a sensitive receiver or an area of sensitive receivers has been determined to be inside the screening distance of a proposed alignment or new railway corridor, a Detailed Vibration Assessment is conducted. An FRA Detailed Vibration Assessment consists of:

- Surveying the existing vibration conditions,
- Predicting future vibration and vibration impacts, and
- Developing mitigation measures.

A. SURVEYING THE EXISTING VIBRATION CONDITIONS

Transfer mobility (vibration propagation) is a function of both the frequency and the distance from the source. Unlike the FRA General Vibration Assessment, all frequencies of vibration are taken into account during the FRA Detailed Vibration Assessment. In order to estimate future conditions along existing railway corridors, vibration measurements have been conducted at critical sensitive receivers within the screening distance. Vibration levels caused by existing conditions from trains and other potential vibration generating sources are taken into account. Some of these sources may include industrial processes, quarrying operations and traffic. Tables 3-26 and 3-27 establish ground-borne vibration and noise thresholds for different land uses and special buildings. Vibration measurement results for sensitive receivers located within the screening distance for existing railway corridors are located in Section 4.4 of this report.

Vibration measurements conducted with the use of transfer mobility testing are used in order to predict future vibration levels as a result of the HST project in areas where there are no existing railway corridors. Transfer mobility testing defines the vibration propagation characteristics near a sensitive receiver due to the geological composition of the surrounding area. The source is best characterized as a line source. Transfer mobility testing is a vibration propagation procedure aimed at measuring the force of an impact by reading the vibration pulses at varying distances along two perpendicular linear systems of accelerometers. Figure 5-5 illustrates an example of what a transfer mobility test procedure setup would look like. The propagation procedure test consists of dropping a weight on the ground (force density) and measuring the force of the impact at each accelerometer along the linear setups. Taking the vibration measurement results at each accelerometer due to the force density helps calculate vibration propagation characteristics in the surrounding area near sensitive receivers. These transfer functions take all propagation paths into account and define the relationship between a source causing vibration and the resulting propagation of vibration due to the geological composition of the ground.



Source: ATS Consulting 2008

Figure 5-5
Transfer mobility testing illustration

B. PREDICTING FUTURE VIBRATION AND VIBRATION IMPACTS

Once transfer mobility testing has been completed, vibration propagation paths are empirically defined near sensitive receivers near proposed HST project railway corridors. The data is taken from each accelerometer used at each location in order to calculate 1/3 octave band transfer mobilities from the narrowband results as a function of distance. Tables 3-26 and 3-27 list the criteria that are recommended by the FRA for ground-borne vibration and noise at sensitive land uses. Figure 3-6 and Table 3-28 are used for the FRA Detailed Vibration Assessment. Figure 3-6 shows sensitive land uses and their corresponding one-third octave maximum allowable vibration levels. The projected vibration source levels caused by the implementation of the HST project can be input into a formula along with the results from transfer mobility testing in order to estimate what the vibration levels caused by the train sources are at sensitive receivers due to HST project conditions. The following formula is used to calculate the vibration level at sensitive receivers. The formula that defines vibration levels at sensitive receivers consists of transfer mobility, force density and vibration adjustments that account for ground-building interaction at the receiver.

$$L_V = L_F + TM_{line} + C_{build}$$

where: L_V = RMS vibration velocity level in one 1/3 octave band,

L_F = force density for a line vibration source such as a train,

TM_{line} = line source transfer mobility from the tracks to the sensitive site,

C_{build} = adjustments to account for ground-building foundation interaction and attenuation of vibration amplitudes as vibration propagates through buildings

There are some situations where a single impact point is the only practical method to apply to transfer mobility testing. One of these situations includes elevated guideway columns where vibration from the high speed train is propagated through the track structure and into the ground via individual columns. The following formula is used to calculate an equivalent line source transfer mobility using numerical integration from the results at each accelerometer location. Transfer mobility will vary from sensitive receiver to sensitive receiver depending on the area.

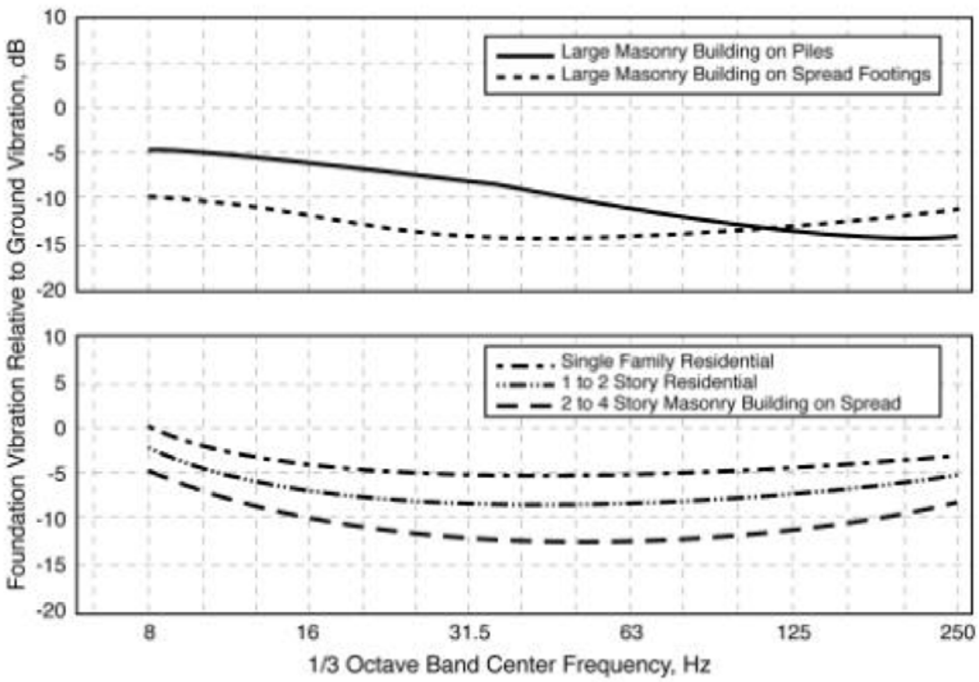
$$TM_{line} = \left[h \times \left(\frac{10^{\frac{TM_{p1}}{10}}}{2} + 10\frac{TM_{p_2}}{10} + \ldots 10\frac{TM_{p_{n-1}}}{10} + \frac{10^{\frac{TM_{pn}}{10}}}{2} \right) \right]$$

where: *h* = impact interval,

TM_{pi} = point source transfer mobility for *i*th impact location, and

N = last impact location

Figure 5-6 illustrates the adjustments that need to be made to the overall vibration level at sensitive receivers due to the type of building structure that the sensitive receiver is located in. The frequencies range from 8 to 250 Hz. The top half of the figure illustrates foundation vibration relative to ground vibration in VdB for large masonry buildings and the bottom half of the figure illustrates vibration for residential buildings. This adjustment is represented as "C_{build}" in the formula that defines levels of vibration at sensitive receivers.



Source: FRA 2005

Figure 5-6
Approximate foundation response for various types of buildings

Section 6.0

Noise and Vibration Impacts

6.0 Noise and Vibration Impacts

6.1 Operations

The operational parameters that were used to model future with project noise levels were provided by the environmental program manager for the high speed rail authority. This data includes the type of HST car to be modeled, the number of cars per train, the length of the train, the number of operations expected throughout the day, and the basic track geometries for the at-grade and aerial portions of the project alignment. These parameters are summarized in Table 6-1. Note that any change in the number of operations, particularly during nighttime hours, will result in a change in predicted noise levels. The reference noise data used to model the HST operations were taken from the HS EMU systems for the propulsion and wheel rail sources and the VHS Electric systems for the aerodynamic source, which are listed in Table 5-1. A specific speed profile for the entire project alignment was not available; therefore, to conduct the most conservative analysis, the speed of the trains was assumed to be 220 mph along the entire project corridor for all trains. Any changes to the speeds of the modeled operations will result in a change in the corresponding noise impacts.

Table 6-1
HST Operational and Geometric Assumptions

Parameter	Value
Number of Cars per train	10
Number of Powered Cars per train	10
Car length	60 feet
Train length	600 feet
Number of Daytime Operations	188
Number of Nighttime Operations	37
Number of Peak Hour Trains	24
Maximum Speed	220 mph
Track Geometry	Two Track – 16.5 feet on center
Geometric Cross-Sections	Two Types: At-Grade and Aerial
Near Track to Noise Barrier – At-Grade	21.5 feet
Near Track to Noise Barrier – Aerial	15.5 feet

The projected HST noise and vibration levels were calculated at each noise measurement location along the project alignment using the operational assumptions listed above. The calculated noise levels were then compared to the measured noise levels at each location, and the moderate impacts and severe impact distances were determined. The project alignment was subdivided into seven sections between Fresno and Bakersfield. The results of the analysis are presented for each project section.

6.2 Noise Impacts Due to Project Operations

According to FRA impact criteria, the potential for noise impacts for this project is determined by comparing the increase in noise exposure levels attributable to the proposed project with the ambient noise environment into which the project is being constructed. Noise impacts are determined using two types of impact classifications, namely moderate impacts and severe impacts. The noise impact analysis was conducted for this project using FRA methodology (Section 3.2.1), and the results of the impact analysis are listed in the following sections for each project alternative. Figures in Appendix F show all sensitive receivers that would experience either moderate or severe impacts as a result of train operations.

6.2.1 BNSF Alternative Alignment Through Fresno

This portion of the project alignment extends from the west end of the Fresno station to just north of E. Lincoln Avenue. The BNSF Alternative Alignment through Fresno is the only project alternative that is included in this portion of the project alignment: The source height refers to the elevation of the track relative to the surrounding grade. In this case, the track will be at-grade level. There are a total of 23 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 59 to 79 dBA Ldn. The noise measurement results for all sites are presented in Tables 4-2 and 4-3. The existing noise levels for the 4(f) and historical structure (HP) sites were interpolated from the short-term and long-term measurement data. The project noise levels at all of the measurement sites range from 55 to 70 dBA Ldn. Project impacts (either none, moderate, or severe) are determined based upon the difference between the project noise level and the existing noise level (Figure 3-3). The impacts for the BNSF Alternative Alignment through Fresno are listed in Table 6-2. The distances to the severe and moderate impact thresholds were calculated for each modeling site as measured from the alignment centerline, and the results are included in the table. The reported noise level values listed in the Operational Noise Levels tables within this section are rounded to the nearest whole number.

The increase in noise level due to the BNSF Alternative Alignment through Fresno would be as high as 5 dBA Ldn at the noise measurement sites and 19 dBA Ldn at a modeled historical structure site. The results of the analysis show there is a potential for moderate and severe noise impacts for some of the receivers along the project alignment according to the FRA impact criteria. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Tables 6-2 and 6-3. These values represent the distances to the severe and moderate impact thresholds taking into account the existing ambient level and the future HST noise levels at each modeling site. From these values generalized contours were developed and analyzed with respect to existing electronic land use maps along the project alignment. The number of noise-sensitive land uses located within these impact contours were counted for each project alternative and the results are presented in Table 6-3. Counts of individual severe impacts are for those properties which are located between the project alignment and the severe noise contour. Counts for individual moderate impacts are for the properties which are located between the severe contour and the moderate contour. Noise mitigation measures will need to be considered for these project alignments.

Table 6-2
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Fresno

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-128	F4	BNSF - Fresno	8	1,150	Residential	65	62	67	2	Moderate	507	1,468
LT-129	F4	BNSF - Fresno	10	224	Residential	79	70	80	1	Moderate	92	643
LT-130	F4	BNSF - Fresno	10	476	Residential	69	67	71	2	Moderate	292	803
LT-132	F4	BNSF - Fresno	3	317	Residential	75	68	76	1	Moderate	122	613
LT-133	F4	BNSF - Fresno	3	531	Residential	71	66	72	1	Moderate	232	613
LT-134	F4	BNSF - Fresno	3	690	Residential	69	64	70	1	Moderate	312	853
LT-152	F4	BNSF - Fresno	3	1,926	Residential	64	59	65	1	None	532	1,553
LT-153	F4	BNSF - Fresno	3	3,869	Residential	65	56	65	1	None	512	1,493
LT-154	F4	BNSF - Fresno	3	1,886	Residential	65	59	66	1	None	512	1,483
LT-155	F4	BNSF - Fresno	3	1,992	Residential	63	59	64	2	None	627	1,868
ST-124	F4	BNSF - Fresno	10	714	Residential	66	65	68	2	Moderate	442	1,263
ST-126	F4	BNSF - Fresno	7	1,290	Residential	69	61	70	1	None	307	838
ST-127	F4	BNSF - Fresno	3	544	Residential	67	66	69	2	Moderate	392	1,093
ST-132	F4	BNSF - Fresno	3	402	Residential	64	67	69	5	Severe	562	1,663
ST-144	F4	BNSF - Fresno	3	1,633	Institutional	67	60	68	1	None	152	413
ST-145	F4	BNSF - Fresno	3	1,877	Institutional	61	60	64	2	None	282	823
ST-146	F4	BNSF - Fresno	3	2,415	Institutional	71	58	71	0	None	87	238
ST-147	F4	BNSF - Fresno	3	2,775	Institutional	60	58	62	2	None	337	1,018
ST-149	F4	BNSF - Fresno	3	4,161	Institutional	61	56	62	1	None	292	853
ST-150	F4	BNSF - Fresno	3	2,780	Institutional	59	58	62	2	None	347	1,048
ST-151	F4	BNSF - Fresno	3	2,628	Institutional	67	58	67	1	None	157	428
ST-152	F4	BNSF - Fresno	3	4,856	Residential	74	55	74	0	None	152	613
ST-154	F4	BNSF - Fresno	3	4,422	Residential	63	55	64	1	None	602	1,793
4F-012	F4	BNSF - Fresno	3	399	Institutional	64	67	69	5	Moderate	222	623
4F-016	F4	BNSF - Fresno	3	1,109	Institutional	61	62	65	4	None	297	868
4F-017	F4	BNSF - Fresno	3	397	Institutional	64	67	69	5	Moderate	222	623
4F-018	F4	BNSF - Fresno	3	541	Institutional	64	66	68	4	Moderate	217	608
4F-019	F4	BNSF - Fresno	3	2,313	Institutional	61	59	63	2	None	297	868
4F-022	F4	BNSF - Fresno	3	1,713	Institutional	64	60	66	1	None	207	588
4F-024	F4	BNSF - Fresno	3	393	Institutional	64	67	69	5	Moderate	222	623
4F-029	F4	BNSF - Fresno	3	1,343	Institutional	63	61	65	2	None	242	703
4F-030	F4	BNSF - Fresno	3	1,778	Institutional	63	60	65	2	None	242	703
4F-031	F4	BNSF - Fresno	3	1,907	Institutional	63	59	64	2	None	242	703
4F-033	F4	BNSF - Fresno	3	267	Institutional	75	69	76	1	None	77	238
4F-034	F4	BNSF - Fresno	3	1,501	Institutional	63	61	65	2	None	242	703
4F-035	F4	BNSF - Fresno	3	707	Institutional	64	64	67	3	None	217	608
4F-038	F4	BNSF - Fresno	3	232	Institutional	64	70	71	7	Moderate	222	623
4F-039	F4	BNSF - Fresno	3	2,717	Institutional	59	58	62	2	None	347	1,048

Table 6-2
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Fresno

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
4F-044	F4	BNSF - Fresno	3	1,344	Institutional	61	61	64	3	None	297	868
4F-048	F4	BNSF - Fresno	3	1,103	Institutional	61	62	65	4	None	297	868
4F-054	F4	BNSF - Fresno	3	297	Institutional	75	69	76	1	None	77	238
4F-056	F4	BNSF - Fresno	3	230	Residential	69	70	72	4	Severe	312	863
HP-001	F4	BNSF - Fresno	3	1,106	Institutional	62	62	65	3	None	262	753
HP-002	F4	BNSF - Fresno	3	1,101	Institutional	62	62	65	3	None	262	753
HP-003	F4	BNSF - Fresno	3	1,037	Institutional	65	62	67	2	None	197	558
HP-004	F4	BNSF - Fresno	3	938	Institutional	62	63	66	3	None	262	753
HP-005	F4	BNSF - Fresno	3	795	Institutional	71	64	72	1	None	87	238
HP-006	F4	BNSF - Fresno	3	622	Institutional	65	65	68	3	None	197	558
HP-007	F4	BNSF - Fresno	3	626	Institutional	65	65	68	3	None	197	558
HP-008	F4	BNSF - Fresno	3	939	Institutional	61	63	65	4	None	297	868
HP-015	F4	BNSF - Fresno	3	171	Institutional	62	72	72	10	Severe	262	753
HP-017	F4	BNSF - Fresno	3	445	Institutional	65	67	69	4	Moderate	197	558
HP-018	F4	BNSF - Fresno	3	17	Institutional	65	84	84	19	Severe	197	558
HP-019	F4	BNSF - Fresno	3	383	Institutional	62	68	69	6	Moderate	262	753
HP-020	F4	BNSF - Fresno	3	224	Institutional	65	70	71	7	Moderate	197	558
HP-021	F4	BNSF - Fresno	3	308	Institutional	65	69	70	5	Moderate	197	558
HP-022	F4	BNSF - Fresno	3	225	Institutional	65	70	71	7	Moderate	197	558
HP-023	F4	BNSF - Fresno	3	398	Institutional	65	67	69	5	Moderate	197	558
HP-024	F4	BNSF - Fresno	3	422	Institutional	65	67	69	4	Moderate	197	558
HP-025	F4	BNSF - Fresno	3	396	Institutional	65	67	69	5	Moderate	197	558
HP-026	F4	BNSF - Fresno	3	396	Institutional	65	67	69	5	Moderate	197	558
HP-027	F4	BNSF - Fresno	3	699	Institutional	62	64	66	4	Moderate	262	753
HP-028	F4	BNSF - Fresno	3	701	Institutional	62	64	66	4	Moderate	262	753
HP-029	F4	BNSF - Fresno	3	402	Residential	69	67	71	2	Moderate	312	863
HP-030	F4	BNSF - Fresno	3	528	Institutional	69	66	70	2	None	122	333
HP-031	F4	BNSF - Fresno	3	266	Institutional	69	69	72	4	Moderate	122	333
HP-032	F4	BNSF - Fresno	3	194	Institutional	71	71	74	3	Moderate	92	243
HP-064	F4	BNSF - Fresno	9	39	Institutional	63	80	80	17	Severe	247	718

Table 6-3
Noise Impacts – BNSF Alternative Alignment Through Fresno

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	500	20	0	0	0	0	15
Moderate	1,325	171	0	0	7	2	17

6.2.2 BNSF Alternative Alignment Through Hanford East

This portion of the project alignment extends from just north of E. Lincoln Avenue down to just north of Idaho Avenue. The BNSF Alternative Alignment Hanford - East is the only alternative under consideration for this portion of the project. The track will predominantly be "at-grade", and the fill and ballast for this portion will be built up to an elevation of about ten (10) feet above the existing ground. There are 61 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 47 to 77 dBA Ldn. The existing noise levels for the 4(f), Hanford East (HE), and historical structure sites were interpolated from the short-term and long-term measurement data. The project noise levels at all of the sites range from 50 to 84 dBA Ldn. The impacts for the BNSF Alternative Alignment Hanford–East are listed in Table 6-4.

The increase in noise level along this project alternative would be as high as 28 dBA Ldn. The results of the analysis show there is a potential for moderate and severe noise impacts for most of the receivers along the project alignment. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Table 6-4. The number of noise-sensitive land uses located within these impact contours is counted for the BNSF Alternative Alignment Hanford–East and the results are presented in Table 6-5. Noise mitigation measures will need to be considered for this project alignment.

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-087	H2	BNSF - Hanford East	5	620	Residential	68	65	70	2	Moderate	342	953
LT-088	H2	BNSF - Hanford East	6	1,361	Residential	65	61	66	2	Moderate	497	1,448
LT-089	H2	BNSF - Hanford East	3	185	Residential	58	71	71	14	Severe	1,027	3,298
LT-090	H2	BNSF - Hanford East	3	1,797	Residential	58	60	62	4	Moderate	987	3,148
LT-091	H2	BNSF - Hanford East	20	2,147	Residential	52	59	60	7	Moderate	1,626	5,711
LT-092	H2	BNSF - Hanford East	30	90	Residential	60	73	74	13	Severe	926	2,891
LT-093	H2	BNSF - Hanford East	30	138	Residential	55	72	72	17	Severe	1,451	4,826
LT-094	H2	BNSF - Hanford East	3	1,492	Residential	56	61	62	6	Moderate	1,207	3,978
LT-095	H2	BNSF - Hanford East	3	2,580	Residential	60	58	62	2	None	807	2,488
LT-096	H2	BNSF - Hanford East	3	2,595	Residential	59	58	62	2	Moderate	882	2,763
LT-097	H2	BNSF - Hanford East	3	4,589	Residential	55	55	58	3	None	1,287	4,288
LT-098	H2	BNSF - Hanford East	3	4,319	Residential	56	55	59	3	None	1,207	3,978
LT-099	H2	BNSF - Hanford East	3	2,117	Residential	59	59	62	3	Moderate	967	3,078
LT-100	H2	BNSF - Hanford East	3	1,675	Residential	61	60	63	3	Moderate	792	2,433
LT-101	H2	BNSF - Hanford East	6	5,220	Residential	50	55	56	6	Moderate	1,882	6,953
LT-102	H2	BNSF - Hanford East	6	4,465	Residential	49	55	56	7	Moderate	1,947	7,308
LT-103	H2	BNSF - Hanford East	5	3,498	Residential	47	56	57	10	Moderate	2,087	8,218
LT-104	H2	BNSF - Hanford East	6	6,192	Residential	63	54	63	0	None	627	1,868
LT-105	H2	BNSF - Hanford East	6	6,367	Residential	58	54	59	1	None	1,082	3,483
LT-106	H2	BNSF - Hanford East	11	6,883	Residential	50	53	55	5	Moderate	1,947	7,118
LT-107	H2	BNSF - Hanford East	19	9,133	Residential	54	53	56	2	None	1,687	5,728
LT-108	H2	BNSF - Hanford East	15	9,122	Residential	51	52	55	4	None	1,962	7,043

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-109	H2	BNSF - Hanford East	11	8,980	Residential	61	52	62	1	None	787	2,408
LT-110	H2	BNSF - Hanford East	8	8,621	Residential	63	52	63	0	None	632	1,873
LT-111	H2	BNSF - Hanford East	12	4,267	Residential	57	56	59	3	None	1,217	3,948
LT-112	H2	BNSF - Hanford East	9	1,708	Residential	63	60	65	2	Moderate	607	1,788
LT-113	H2	BNSF - Hanford East	8	167	Residential	64	72	73	9	Severe	587	1,728
LT-114	H2	BNSF - Hanford East	12	130	Residential	66	73	74	8	Severe	447	1,278
LT-115	H2	BNSF - Hanford East	43	68	Residential	74	73	76	2	Severe	91	796
LT-116	H2	BNSF - Hanford East	13	187	Residential	64	72	72	8	Severe	617	1,818
LT-117	H2	BNSF - Hanford East	12	535	Residential	65	66	68	4	Severe	552	1,613
LT-118	H2	BNSF - Hanford East	7	442	Residential	70	67	72	2	Moderate	257	688
LT-119	H2	BNSF - Hanford East	6	752	Residential	68	64	69	2	Moderate	357	998
LT-120	H2	BNSF - Hanford East	13	124	Residential	77	74	79	2	Moderate	97	668
LT-121	H2	BNSF - Hanford East	9	270	Residential	66	69	71	5	Severe	457	1,318
LT-122	H2	BNSF - Hanford East	7	121	Residential	75	74	77	2	Severe	127	628
LT-123	H2	BNSF - Hanford East	9	194	Residential	64	71	72	8	Severe	547	1,598
LT-124	H2	BNSF - Hanford East	7	268	Residential	70	69	73	3	Moderate	257	698
LT-125	H2	BNSF - Hanford East	13	970	Residential	58	63	64	6	Severe	1,107	3,528
LT-126	H2	BNSF - Hanford East	10	980	Residential	67	63	68	2	Moderate	412	1,173
LT-127	H2	BNSF - Hanford East	8	178	Residential	66	72	73	7	Severe	452	1,293
ST-107	H2	BNSF - Hanford East	10	2,142	Residential	59	59	62	3	Moderate	1,012	3,193
ST-108	H2	BNSF - Hanford East	6	2,439	Residential	57	58	61	4	Moderate	1,117	3,608
ST-109	H2	BNSF - Hanford East	7	2,375	Residential	60	58	62	2	Moderate	847	2,628

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-110	H2	BNSF - Hanford East	3	1,263	Residential	60	61	64	4	Moderate	867	2,698
ST-111	H2	BNSF - Hanford East	3	3,919	Residential	59	56	61	2	None	942	2,983
ST-112	H2	BNSF - Hanford East	3	1,413	Residential	58	61	63	5	Moderate	1,017	3,258
ST-113	H2	BNSF - Hanford East	3	2,763	Residential	56	58	60	4	Moderate	1,212	3,993
ST-114	H2	BNSF - Hanford East	12	7,722	Residential	68	53	68	0	None	357	1,008
ST-115a	H2	BNSF - Hanford East	13	1,274	Residential	59	62	64	4	Moderate	992	3,123
ST-115b	H2	BNSF - Hanford East	6	697	Residential	62	64	66	4	Severe	702	2,123
ST-115c	H2	BNSF - Hanford East	35	1,442	Residential	58	62	63	5	Moderate	1,221	3,926
ST-116	H2	BNSF - Hanford East	23	690	Residential	59	65	66	7	Severe	1,011	3,216
ST-117	H2	BNSF - Hanford East	6	2,261	Residential	65	59	66	1	None	477	1,378
ST-118	H2	BNSF - Hanford East	11	1,368	Institutional	64	61	66	2	None	222	643
ST-119	H2	BNSF - Hanford East	3	753	Residential	62	64	66	4	Moderate	667	2,008
ST-120	H2	BNSF - Hanford East	13	1,150	Residential	59	62	64	5	Moderate	1,052	3,333
ST-121b	H2	BNSF - Hanford East	6	290	Residential	67	69	71	4	Severe	387	1,088
ST-121	H2	BNSF - Hanford East	7	806	Institutional	61	64	66	5	Moderate	312	923
ST-122	H2	BNSF - Hanford East	6	876	Residential	70	63	71	1	None	252	683
ST-123	H2	BNSF - Hanford East	10	237	Residential	61	70	71	10	Severe	812	2,493
ST-125	H2	BNSF - Hanford East	10	696	Residential	62	65	66	5	Severe	757	2,288
4F-040	H2	BNSF - Hanford East	11	1,396	Institutional	64	61	66	2	None	222	643
4F-043	H2	BNSF - Hanford East	7	851	Institutional	61	64	65	5	Moderate	312	923
4F-053a	H2	BNSF - Hanford East	5	5,512	Institutional	57	54	59	2	None	452	1,413
HE-001	H2	BNSF - Hanford East	12	93	Residential	66	75	76	9	Severe	447	1,278

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HE-002	H2	BNSF - Hanford East	7	549	Residential	64	66	68	4	Severe	582	1,713
HE-003	H2	BNSF - Hanford East	10	72	Residential	62	76	77	15	Severe	722	2,183
HE-004	H2	BNSF - Hanford East	9	1,134	Residential	60	62	64	4	Moderate	882	2,733
HE-005a	H2	BNSF - Hanford East	8	164	Residential	64	72	73	9	Severe	567	1,668
HE-005	H2	BNSF - Hanford East	9	387	Residential	64	68	69	5	Severe	572	1,683
HE-005c	H2	BNSF - Hanford East	9	1,171	Residential	64	62	66	2	Moderate	572	1,683
HE-005	H2	BNSF - Hanford East	8	97	Residential	64	75	75	11	Severe	567	1,668
HE-006a	H2	BNSF - Hanford East	8	516	Residential	63	66	68	5	Severe	607	1,798
HE-006b	H2	BNSF - Hanford East	10	184	Residential	63	72	72	9	Severe	617	1,828
HE-007	H2	BNSF - Hanford East	3	588	Residential	64	65	68	4	Moderate	547	1,598
HE-008	H2	BNSF - Hanford East	7	1,463	Residential	62	61	64	2	Moderate	702	2,123
HE-009a	H2	BNSF - Hanford East	8	1,183	Residential	57	62	63	6	Moderate	1,157	3,748
HE-009	H2	BNSF - Hanford East	9	473	Residential	57	67	67	10	Severe	1,167	3,788
HE-010a	H2	BNSF - Hanford East	13	499	Residential	60	67	67	7	Severe	917	2,848
HE-010	H2	BNSF - Hanford East	17	174	Residential	60	72	72	12	Severe	962	2,983
HE-011	H2	BNSF - Hanford East	10	1,024	Residential	54	63	63	9	Severe	1,497	5,088
HE-012a	H2	BNSF - Hanford East	15	1,460	Residential	50	61	62	12	Severe	2,022	7,343
HE-012b	H2	BNSF - Hanford East	12	1,894	Residential	50	60	60	10	Severe	1,957	7,118
HE-012c	H2	BNSF - Hanford East	19	1,505	Residential	50	61	62	12	Severe	2,122	7,683
HE-012d	H2	BNSF - Hanford East	9	1,069	Residential	50	62	63	13	Severe	1,897	6,928
HE-012	H2	BNSF - Hanford East	13	283	Residential	54	69	70	16	Severe	1,547	5,238
HE-013a	H2	BNSF - Hanford East	14	157	Residential	54	72	73	19	Severe	1,562	5,293

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HE-013	H2	BNSF - Hanford East	14	279	Residential	54	70	70	16	Severe	1,562	5,293
HE-014a	H2	BNSF - Hanford East	13	1,096	Residential	54	63	63	9	Severe	1,547	5,238
HE-014	H2	BNSF - Hanford East	13	223	Residential	54	71	71	17	Severe	1,547	5,238
HE-015a	H2	BNSF - Hanford East	13	92	Residential	50	75	75	25	Severe	1,977	7,188
HE-015	H2	BNSF - Hanford East	17	420	Residential	50	68	68	18	Severe	2,067	7,508
HE-016a	H2	BNSF - Hanford East	9	1,232	Residential	58	62	63	5	Moderate	1,067	3,408
HE-016b	H2	BNSF - Hanford East	10	753	Residential	58	64	65	7	Severe	1,082	3,443
HE-016	H2	BNSF - Hanford East	8	850	Residential	58	64	65	7	Severe	1,057	3,378
HE-017	H2	BNSF - Hanford East	7	332	Residential	54	68	68	14	Severe	1,457	4,958
HE-018	H2	BNSF - Hanford East	3	16	Residential	56	84	84	28	Severe	1,212	3,993
HE-019	H2	BNSF - Hanford East	5	678	Residential	54	65	65	11	Severe	1,427	4,878
HE-020	H2	BNSF - Hanford East	7	1,223	Residential	56	62	63	7	Severe	1,247	4,108
HE-021a	H2	BNSF - Hanford East	5	924	Residential	52	63	63	11	Severe	1,632	5,773
HE-021	H2	BNSF - Hanford East	7	395	Residential	52	67	68	16	Severe	1,662	5,863
HE-022	H2	BNSF - Hanford East	5	382	Residential	54	68	68	14	Severe	1,427	4,878
HE-023	H2	BNSF - Hanford East	5	430	Residential	56	67	67	11	Severe	1,227	4,038
HE-024	H2	BNSF - Hanford East	5	816	Residential	58	64	65	7	Severe	1,027	3,288
HE-025	H2	BNSF - Hanford East	4	666	Residential	50	65	65	15	Severe	1,812	6,663
HE-026	H2	BNSF - Hanford East	3	41	Residential	56	79	79	23	Severe	1,212	3,993
HE-027a	H2	BNSF - Hanford East	3	637	Residential	58	65	66	8	Severe	1,017	3,258
HE-027b	H2	BNSF - Hanford East	3	1,139	Residential	58	62	63	5	Moderate	1,017	3,258
HE-027c	H2	BNSF - Hanford East	3	1,535	Residential	58	60	62	4	Moderate	1,017	3,258

Table 6-4
Operational Noise Levels and Contours – BNSF Alternative Alignment Hanford–East

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HE-027	H2	BNSF - Hanford East	3	196	Residential	58	71	71	13	Severe	1,017	3,258
HE-028	H2	BNSF - Hanford East	3	517	Residential	52	66	66	14	Severe	1,612	5,713
HE-029a	H2	BNSF - Hanford East	3	216	Residential	52	70	71	19	Severe	1,612	5,713
HE-029	H2	BNSF - Hanford East	3	441	Residential	52	67	67	15	Severe	1,612	5,713
HE-030	H2	BNSF - Hanford East	3	497	Residential	54	66	66	12	Severe	1,412	4,823
HE-031	H2	BNSF - Hanford East	20	1,926	Residential	52	59	60	8	Moderate	1,651	5,836
HP-033	H2	BNSF - Hanford East	5	5,506	Residential	58	54	59	2	None	1,077	3,468
HP-050	H2	BNSF - Hanford East	3	4,590	Institutional	55	55	58	3	None	492	1,563
HP-065	H2	BNSF - Hanford East	9	14	Institutional	63	62	66	3	None	247	718
HP-066	H2	BNSF - Hanford East	3	100	Institutional	58	75	75	17	Severe	412	1,263
HP-067	H2	BNSF - Hanford East	5	1,366	Institutional	58	61	63	5	None	412	1,283
HP-068	H2	BNSF - Hanford East	20	50	Institutional	58	76	76	18	Severe	386	1,191

Table 6-5
Noise Impacts – The BNSF Alternative Alignment Hanford–East

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,400	329	3	0	1	0	0
Moderate	3,600	420	4	0	1	0	0

6.2.3 BNSF Alternative Alignment Through Corcoran

This portion of the project alignment extends from just north of Idaho Avenue to just northwest of the intersection of Avenue 128 and Road 32. The BNSF Alternative Alignment through Corcoran will be elevated between at-grade elevations to 55 feet above the ground level. The Corcoran Bypass around the east side of the City of Corcoran will be at-grade at an elevation of about 10 feet above the existing grade and range up to 50 feet above the ground level. The Corcoran Elevated Alternative extends north to south from Niles Avenue to 4th Avenue. The Corcoran Elevated Alternative is an elevated option for the BNSF Alternative Alignment through Corcoran that would elevate the track at 33 feet above ground level as the track runs through the City of Corcoran. There are 23 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 47 to 84 dBA Ldn, and the project noise levels at these sites range from 53 to 79 dBA Ldn. The impacts for the BNSF Alternative Alignment through Corcoran, the Corcoran Bypass Alternative, and the Corcoran Elevated Alternative are listed in Tables 6-6, 6-7, and 6-8, respectively.

The increase in noise level along the BNSF Alternative Alignment through Corcoran would be as high as 20 dB Ldn at the location that is located less than 50 feet from the project alignment. The increase in noise level along the Corcoran Bypass Alternative would be as high as 20 dB Ldn at a location less than 50 feet from the alignment. The increase in noise level along the Corcoran Elevated Alternative would be as high as 8 dBA Ldn. The results of the analysis show there is a potential for moderate and severe noise impacts for most of the receivers along the project alignment. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site for each project alternative, and these results are also presented in Tables 6-6, 6-7, and 6-8, respectively.

The number of noise-sensitive land uses located within these impact contours were counted for each alternative and the results are presented in Tables 6-9, 6-10, and 6-11. Table 6-12 is included for comparison purposes of noise impacts for the Alternative Alignment through Corcoran elevated and "at-grade." The "at-grade" distances in Table 6-12 are estimated. Noise mitigation measures will need to be considered for all of these project alignments.

Table 6-6
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Corcoran

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-059	C3	BNSF Corcoran	16	922	Residential	65	64	67	2	Moderate	532	1,553
LT-060	C3	BNSF Corcoran	16	1,943	Residential	70	60	71	0	None	267	728
LT-061	C3	BNSF Corcoran	15	792	Residential	66	64	68	2	Moderate	477	1,378
LT-062	C3	BNSF Corcoran	32	782	Residential	61	64	66	5	Severe	831	2,556
LT-063	C3	BNSF Corcoran	12	4,823	Residential	68	55	68	0	None	362	1,003
LT-064	C3	BNSF Corcoran	3	375	Residential	81	68	81	0	Moderate	92	613
LT-065	C3	BNSF Corcoran	4	100	Residential	78	75	80	1	Moderate	92	613
LT-066	C3	BNSF Corcoran	7	531	Residential	64	66	68	4	Severe	532	1,553

Table 6-6
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Corcoran

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-067	C3	BNSF Corcoran	7	220	Residential	65	70	72	6	Severe	472	1,353
LT-068	C3	BNSF Corcoran	9	577	Residential	64	66	68	4	Moderate	562	1,653
LT-069	C3	BNSF Corcoran	3	5,950	Residential	48	54	55	7	Moderate	2,002	7,733
LT-070	C3	BNSF Corcoran	3	4,463	Residential	51	55	57	6	Moderate	1,697	6,108
LT-071	C3	BNSF Corcoran	9	413	Residential	73	67	74	1	Moderate	177	638
LT-072	C3	BNSF Corcoran	7	3,822	Residential	53	56	58	5	Moderate	1,612	5,623
LT-073	C3	BNSF Corcoran	4	4,632	Residential	84	55	84	0	None	92	613
LT-074	C3	BNSF Corcoran	11	5,552	Residential	56	54	58	2	None	1,307	4,298
LT-075	C3	BNSF Corcoran	12	383	Residential	72	68	73	1	Moderate	217	658
LT-076	C3	BNSF Corcoran	11	6,415	Residential	73	54	73	0	None	187	648
LT-077	C3	BNSF Corcoran	12	5,772	Residential	54	54	57	3	None	1,497	5,058
LT-078	C3	BNSF Corcoran	11	4,765	Residential	71	55	71	0	None	237	648
LT-079	C3	BNSF Corcoran	11	3,634	Residential	58	57	60	2	None	1,107	3,538
LT-080	C3	BNSF Corcoran	11	4,844	Residential	56	55	58	3	None	1,332	4,403
LT-081	C3	BNSF Corcoran	7	1,638	Residential	57	60	62	5	Moderate	1,117	3,598
LT-082	C3	BNSF Corcoran	11	3,089	Residential	59	57	61	2	Moderate	1,042	3,293
LT-083	C3	BNSF Corcoran	12	42	Residential	59	79	79	20	Severe	1,017	3,208
LT-084	C3	BNSF Corcoran	9	2,692	Residential	58	58	61	3	Moderate	1,067	3,398
LT-085	C3	BNSF Corcoran	10	1,848	Residential	56	60	61	6	Moderate	1,337	4,428
LT-086	C3	BNSF Corcoran	5	2,277	Residential	65	59	66	1	None	482	1,393
LT-208	C3	BNSF Corcoran	17	7,436	Residential	77	53	77	0	None	107	698
ST-089	C3	BNSF Corcoran	8	2,378	Residential	60	58	62	3	Moderate	917	2,868
ST-090	C3	BNSF Corcoran	14	436	Residential	68	67	71	3	Moderate	357	998
ST-091	C3	BNSF Corcoran	4	412	Residential	70	67	72	2	Moderate	262	703
ST-092	C3	BNSF Corcoran	5	456	Residential	69	67	71	2	Moderate	317	868
ST-093	C3	BNSF Corcoran	6	131	Residential	78	73	80	1	Moderate	92	623
ST-094	C3	BNSF Corcoran	5	40	Residential	78	79	82	4	Severe	92	613
ST-095	C3	BNSF Corcoran	4	836	Residential	62	63	66	4	Moderate	682	2,063
ST-096	C3	BNSF Corcoran	7	1,006	Residential	62	63	65	4	Moderate	732	2,223
ST-097	C3	BNSF Corcoran	5	188	Residential	77	71	78	1	Moderate	97	618
ST-098	C3	BNSF Corcoran	10	6,009	Residential	63	54	63	1	None	677	2,028
ST-099	C3	BNSF Corcoran	4	2,877	Residential	58	57	61	3	Moderate	1,047	3,368
ST-100	C3	BNSF Corcoran	9	3,842	Residential	50	56	57	8	Moderate	1,942	7,163
ST-101	C3	BNSF Corcoran	10	7,344	Residential	47	53	54	7	Moderate	2,147	8,288
ST-102	C3	BNSF Corcoran	10	4,650	Residential	62	55	63	1	None	707	2,128
ST-103	C3	BNSF Corcoran	21	3,287	Residential	59	57	61	2	None	921	2,886
ST-104	C3	BNSF Corcoran	10	3,421	Residential	60	57	62	2	None	872	2,703
ST-105	C3	BNSF Corcoran	6	4,767	Residential	61	55	62	1	None	817	2,508

Table 6-6
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Corcoran

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-106	C3	BNSF Corcoran	8	5,474	Residential	61	54	61	1	None	832	2,563
ST-212	C3	BNSF Corcoran	17	8,442	Residential	77	53	77	0	None	107	698
4F-021	C3	BNSF Corcoran	4	708	Institutional	69	64	70	1	None	122	333
4F-026	C3	BNSF Corcoran	4	320	Institutional	81	69	81	0	None	77	238
HP-054	C3	BNSF Corcoran	12	121	Institutional	60	74	74	14	Severe	342	1,023
HP-055	C3	BNSF Corcoran	12	515	Institutional	75	66	76	1	None	77	248
HP-056	C3	BNSF Corcoran	4	1,825	Institutional	58	60	62	4	None	402	1,243
HP-069	C3	BNSF Corcoran	9	204	Institutional	59	71	71	12	Severe	377	1,148

Table 6-7
Operational Noise Levels and Contours – Corcoran Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-059	C4	Corcoran Bypass	51	677	Residential	65	66	69	4	Severe	681	2,136
LT-060	C4	Corcoran Bypass	43	2,357	Residential	70	60	71	0	None	256	851
LT-061	C4	Corcoran Bypass	32	155	Residential	66	72	73	7	Severe	491	1,426
LT-062	C4	Corcoran Bypass	10	2,598	Residential	61	58	63	2	None	767	2,328
LT-063	C4	Corcoran Bypass	9	1,274	Residential	68	62	69	1	None	352	973
LT-064	C4	Corcoran Bypass	5	2,964	Residential	81	57	81	0	None	92	613
LT-065	C4	Corcoran Bypass	10	2,943	Residential	78	57	78	0	None	92	643
LT-066	C4	Corcoran Bypass	12	840	Residential	64	64	67	3	Moderate	557	1,638
LT-067	C4	Corcoran Bypass	12	1,850	Residential	65	60	67	1	None	492	1,423
LT-068	C4	Corcoran Bypass	10	1,325	Residential	64	61	66	2	Moderate	567	1,668
LT-069	C4	Corcoran Bypass	3	2,572	Residential	48	58	58	11	Moderate	2,002	7,733
LT-070	C4	Corcoran Bypass	10	1,704	Residential	51	60	61	10	Severe	1,802	6,433
LT-071	C4	Corcoran Bypass	9	1,885	Residential	73	60	73	0	None	177	638
LT-072	C4	Corcoran Bypass	3	618	Residential	53	65	65	13	Severe	1,562	5,473
LT-073	C4	Corcoran Bypass	10	1,599	Residential	84	60	84	0	None	92	643

Table 6-7
Operational Noise Levels and Contours – Corcoran Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-074	C4	Corcoran Bypass	12	5,035	Residential	56	55	59	3	None	1,317	4,338
LT-075	C4	Corcoran Bypass	12	27	Residential	72	79	79	8	Severe	217	658
LT-076	C4	Corcoran Bypass	15	6,392	Residential	73	54	73	0	None	197	678
LT-077	C4	Corcoran Bypass	13	5,745	Residential	54	54	57	3	None	1,517	5,108
LT-078	C4	Corcoran Bypass	15	4,739	Residential	71	55	71	0	None	242	683
LT-079	C4	Corcoran Bypass	12	3,634	Residential	58	57	60	2	None	1,117	3,578
LT-080	C4	Corcoran Bypass	12	4,844	Residential	56	55	58	3	None	1,347	4,448
LT-081	C4	Corcoran Bypass	11	1,634	Residential	57	60	62	5	Moderate	1,162	3,733
LT-082	C4	Corcoran Bypass	12	3,085	Residential	59	57	61	2	Moderate	1,052	3,333
LT-083	C4	Corcoran Bypass	8	46	Residential	59	79	79	20	Severe	977	3,078
LT-084	C4	Corcoran Bypass	8	2,688	Residential	58	58	61	3	Moderate	1,052	3,363
LT-085	C4	Corcoran Bypass	8	1,852	Residential	56	60	61	6	Moderate	1,312	4,343
LT-086	C4	Corcoran Bypass	8	2,275	Residential	65	59	66	1	None	492	1,433
LT-208	C4	Corcoran Bypass	12	7,473	Residential	77	53	77	0	None	107	658
ST-089	C4	Corcoran Bypass	12	2,378	Residential	60	59	62	3	Moderate	957	2,988
ST-090	C4	Corcoran Bypass	25	621	Residential	68	65	70	2	Moderate	341	966
ST-091	C4	Corcoran Bypass	3	3,009	Residential	70	57	70	0	None	262	703
ST-092	C4	Corcoran Bypass	6	3,980	Residential	69	56	69	0	None	317	878
ST-093	C4	Corcoran Bypass	3	3,398	Residential	78	57	78	0	None	92	613
ST-094	C4	Corcoran Bypass	8	3,091	Residential	78	57	78	0	None	92	633
ST-095	C4	Corcoran Bypass	10	3,707	Residential	62	56	63	1	None	722	2,183
ST-096	C4	Corcoran Bypass	12	2,082	Residential	62	59	64	2	Moderate	772	2,333
ST-097	C4	Corcoran Bypass	10	2,711	Residential	77	58	77	0	None	97	648
ST-098	C4	Corcoran Bypass	10	4,271	Residential	63	56	63	1	None	677	2,028
ST-099	C4	Corcoran Bypass	8	118	Residential	58	74	74	16	Severe	1,087	3,488
ST-100	C4	Corcoran Bypass	10	1,266	Residential	50	62	62	12	Severe	1,962	7,233
ST-101	C4	Corcoran Bypass	12	6,266	Residential	47	54	55	8	Moderate	2,192	8,433
ST-102	C4	Corcoran Bypass	11	3,809	Residential	62	56	63	1	None	712	2,153
ST-103	C4	Corcoran Bypass	23	3,200	Residential	59	57	61	2	None	936	2,941
ST-104	C4	Corcoran Bypass	12	3,420	Residential	60	57	62	2	None	892	2,753
ST-105	C4	Corcoran Bypass	11	4,763	Residential	61	55	62	1	None	857	2,638
ST-106	C4	Corcoran Bypass	6	5,473	Residential	61	54	61	1	None	817	2,508
ST-212	C4	Corcoran Bypass	12	8,479	Residential	77	53	77	0	None	107	658
4F-021	C4	Corcoran Bypass	3	4,108	Institutional	69	56	69	0	None	122	333
4F-026	C4	Corcoran Bypass	5	3,054	Institutional	81	57	81	0	None	77	238

Table 6-7
Operational Noise Levels and Contours – Corcoran Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HP-054	C4	Corcoran Bypass	12	126	Institutional	60	74	74	14	Severe	342	1,023
HP-055	C4	Corcoran Bypass	10	2,850	Institutional	75	58	75	0	None	77	248
HP-057	C4	Corcoran Bypass	15	625	Institutional	58	66	66	9	Moderate	447	1,388
HP-069	C4	Corcoran Bypass	7	200	Institutional	59	71	71	12	Severe	372	1,123

Table 6-8
Operational Noise Levels and Contours – Corcoran Elevated Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-062	CE	Corcoran Elevated	33	601	Residential	61	66	67	6	Severe	841	2,596
LT-063	CE	Corcoran Elevated	33	4,680	Residential	68	56	68	0	None	376	1,091
LT-064	CE	Corcoran Elevated	33	230	Residential	81	70	81	0	Moderate	91	706
LT-065	CE	Corcoran Elevated	33	252	Residential	78	70	79	1	Moderate	91	706
LT-067	CE	Corcoran Elevated	33	398	Residential	65	68	70	4	Severe	526	1,541
LT-068	CE	Corcoran Elevated	33	577	Residential	66	66	69	3	Moderate	491	1,436
LT-069	CE	Corcoran Elevated	33	5,805	Residential	48	55	55	8	Moderate	2,356	8,981
LT-070	CE	Corcoran Elevated	33	4,308	Residential	51	56	57	6	Moderate	2,001	7,126
LT-071	CE	Corcoran Elevated	33	256	Residential	73	70	75	2	Moderate	146	711
LT-072	CE	Corcoran Elevated	33	3,674	Residential	53	57	58	6	Moderate	1,841	6,396
LT-073	CE	Corcoran Elevated	33	4,481	Residential	65	56	66	0	None	531	1,566
ST-091	CE	Corcoran	33	269	Residential	70	70	73	3	Severe	276	821

Table 6-8
Operational Noise Levels and Contours – Corcoran Elevated Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
		Elevated										
ST-092	CE	Corcoran Elevated	33	596	Residential	69	66	70	2	Moderate	346	1,011
ST-093	CE	Corcoran Elevated	33	277	Residential	78	69	79	1	Moderate	91	706
ST-094	CE	Corcoran Elevated	33	189	Residential	78	71	79	1	Moderate	91	706
ST-095	CE	Corcoran Elevated	33	987	Residential	62	63	66	4	Moderate	791	2,426
ST-097	CE	Corcoran Elevated	33	343	Residential	77	69	77	1	Moderate	91	706
ST-099	CE	Corcoran Elevated	33	2,726	Residential	58	58	61	3	Moderate	1,226	3,951
ST-100	CE	Corcoran Elevated	33	3,686	Residential	50	57	58	8	Moderate	2,181	7,996
4F-021	CE	Corcoran Elevated	33	800	Institutional	69	65	70	1	None	91	376
4F-026	CE	Corcoran Elevated	33	175	Institutional	81	71	81	0	Moderate	91	246
HP-055	CE	Corcoran Elevated	33	515	Institutional	75	67	76	1	None	91	246
HP-056	CE	Corcoran Elevated	33	1,825	Institutional	58	60	62	5	None	461	1,456

Table 6-9
Noise Impacts – BNSF Alternative Alignment Through Corcoran

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,450	536	1	0	2	1	2
Moderate	3,200	1,632	4	2	4	1	0

Table 6-10
Noise Impacts – Corcoran Bypass Alternative

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,450	231	2	0	0	0	0
Moderate	3,200	331	2	0	0	0	0

Table 6-11
Noise Impacts – Corcoran Elevated Alternative – Niles to 4th

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,800	737	1	0	2	1	2
Moderate	3,600	1,763	4	2	4	1	0

Table 6-12
Noise Impacts – Corcoran At-grade Alternative – Niles to 4th

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,000	373	0	0	4	2	0
Moderate	2,000	1,136	2	1	8	4	0

6.2.4 BNSF Alternative Alignment Through Pixley

This portion of the project alignment extends from just northwest of the intersection of Avenue 128 and Road 32 to southwest of Avenue 84. The BNSF Alternative Alignment through Pixley is the only alternative under consideration for this portion of the project. The track will be "at-grade", and the fill and ballast for this portion will be built up to an elevation of about 10 feet above the existing ground. There are 7 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 57 to 65 dBA Ldn. The project noise levels at all of the sites range from 58 to 65 dBA Ldn. The impacts for the BNSF Alternative Alignment through Pixley are listed in Table 6-13.

The increase in noise level along this project alternative would be as high as 4 dBA Ldn at the location with the quietest existing ambient noise level. The results of the analysis show there is a potential for moderate noise impacts for several of the receivers along the project alignment. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Table 6-13. This table lists only the locations where noise measurements were conducted and detailed impact assessments were made.

Table 6-13
Operational Noise Levels and Contours - BNSF Alternative Alignment Through Pixley

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-052	P	BNSF - Pixley	6	958	Residential	64	63	67	2	Moderate	532	1,563
LT-053	P	BNSF - Pixley	9	698	Residential	64	65	67	3	Moderate	572	1,683
LT-054	P	BNSF - Pixley	10	871	Residential	65	64	67	2	Moderate	537	1,568
LT-055	P	BNSF - Pixley	5	1,560	Residential	65	60	66	1	None	477	1,378
LT-058	P	BNSF - Pixley	10	2,125	Residential	65	59	66	1	None	522	1,513
ST-083	P	BNSF - Pixley	8	1,954	Residential	57	59	62	4	Moderate	1,117	3,598
ST-084	P	BNSF - Pixley	5	2,694	Residential	62	58	64	1	None	662	1,983

The number of noise-sensitive land uses located within these impact contours were counted for the BNSF Alternative Alignment through Pixley and the results are presented in Table 6-14. This table lists all of the residentially zoned parcels located within the Severe and Moderate threshold distances. So even though none of the analysis points located within the severe impact contour distance threshold showed a severe impact, two residentially zoned parcels located within the severe impact threshold distance of 1,000 feet could potentially be subject to a severe noise impact. Noise mitigation measures should be considered for this project alignment.

Table 6-14
Noise Impacts – BNSF Alternative Alignment Through Pixley

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,000	2	0	0	0	0	0
Moderate	2,300	4	0	0	0	0	0

6.2.5 BNSF Alternative Alignment Through Allensworth

This portion of the project alignment extends from just south of Avenue 84 to just northwest of Whisler Road. The BNSF Alternative Alignment through Allensworth and the Allensworth Bypass Alternative will predominantly be at-grade and elevated to a height of approximately 10 feet above the existing grade. There are 39 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 51 to 76 dBA Ldn. The existing noise levels for the 4(f) and historical structure sites were interpolated from the short-term and long-term measurement data. The project noise levels at all of the sites for the BNSF Alternative Alignment through Allensworth range from 52 to 78 dBA Ldn and the project noise levels for the Allensworth Bypass Alternative range from 50 to 81 dBA Ldn. The impacts for the BNSF Alternative Alignment through Allensworth and the Allensworth Bypass Alternative are listed in Tables 6-15 and 6-16, respectively.

The increase in noise levels along both alternatives would be as high as 9 dBA Ldn.. The results of the analysis show there is a potential for moderate and severe noise impacts for most of the receivers along the BNSF Alternative Alignment through Allensworth, but only a few moderate and severe impacts for the Allensworth Bypass Alternative. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Tables 6-15 and 6-16, respectively.

The number of noise-sensitive land uses located within these impact contours were counted for the BNSF Alternative Alignment through Allensworth and the Allensworth Bypass Alternative, and the results are presented in Tables 6-17 and 6-18. It should be noted that for the Allensworth Bypass Alternative, if selected, the BNSF mainline may be realigned to be adjacent to the HST bypass alignment. This would move the BNSF mainline away from the existing noise-sensitive sites adjacent to Highway 43. There are (3) three noise-sensitive receivers identified along the bypass alignment that would be impacted if the BNSF tracks are moved. Two of these noise-sensitive receivers are located on Pond Road east of Magnolia Avenue, and the other is located on Magnolia Avenue north of Pond Road. The existing ambient noise level at these sites is estimated to range from 60 to 63 dBA Ldn. The future level at these locations would increase by 3 to 4 dB with HST rail operations, and would increase by 10-13 dB with both HST and BNSF freight operations. Noise mitigation measures will need to be considered at these sites should both of these project alignments be moved to this location.

Table 6-15
Operational Noise Levels and Contours - BNSF Alternative Alignment Through Allensworth

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-026	A2	BNSF Allensworth	28	289	Residential	72	69	74	2	Moderate	186	671
LT-027	A2	BNSF Allensworth	24	1,390	Residential	62	61	65	3	Moderate	716	2,171
LT-028	A2	BNSF Allensworth	7	1,034	Residential	67	63	68	1	Moderate	377	1,068
LT-029	A2	BNSF Allensworth	9	661	Residential	74	65	74	1	None	162	643
LT-030	A2	BNSF Allensworth	9	81	Residential	72	76	77	5	Severe	192	643
LT-044	A2	BNSF Allensworth	8	785	Residential	66	64	68	2	Moderate	472	1,353
LT-045	A2	BNSF Allensworth	9	795	Residential	71	64	72	1	None	222	643
LT-046	A2	BNSF Allensworth	8	402	Residential	73	67	74	1	Moderate	172	633
LT-047	A2	BNSF Allensworth	8	1,541	Residential	60	61	63	3	Moderate	887	2,748

Table 6-15
Operational Noise Levels and Contours - BNSF Alternative Alignment Through Allensworth

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-048	A2	BNSF Allensworth	14	196	Residential	76	71	77	1	Moderate	112	673
LT-049	A2	BNSF Allensworth	11	348	Residential	65	68	70	5	Severe	547	1,598
LT-050	A2	BNSF Allensworth	11	312	Residential	62	69	70	8	Severe	732	2,213
LT-051	A2	BNSF Allensworth	10	228	Residential	69	70	73	4	Severe	322	893
LT-056	A2	BNSF Allensworth	8	2,903	Residential	62	57	63	1	None	747	2,268
LT-057	A2	BNSF Allensworth	8	2,626	Residential	59	58	61	3	Moderate	977	3,078
ST-041	A2	BNSF Allensworth	10	54	Residential	72	78	79	7	Severe	192	643
ST-042	A2	BNSF Allensworth	13	2,447	Residential	70	59	70	0	None	292	803
ST-043	A2	BNSF Allensworth	24	2,373	Residential	55	59	60	5	Moderate	1,396	4,661
ST-044	A2	BNSF Allensworth	23	2,636	Residential	55	58	60	5	Moderate	1,336	4,451
ST-045	A2	BNSF Allensworth	8	2,680	Residential	66	58	66	1	None	462	1,323
ST-046	A2	BNSF Allensworth	6	2,767	Residential	67	58	67	0	None	392	1,103
ST-047	A2	BNSF Allensworth	10	245	Residential	70	70	73	3	Severe	272	743
ST-048	A2	BNSF Allensworth	10	919	Residential	65	63	67	2	Moderate	517	1,508
ST-071	A2	BNSF Allensworth	8	1,171	Residential	67	62	68	1	None	407	1,158
ST-072	A2	BNSF Allensworth	7	645	Residential	65	65	68	3	Moderate	477	1,368
ST-073	A2	BNSF Allensworth	8	197	Residential	72	71	75	2	Severe	197	638
ST-074	A2	BNSF Allensworth	10	707	Residential	67	65	69	2	Moderate	407	1,148
ST-075	A2	BNSF Allensworth	8	1,817	Residential	65	60	66	1	None	487	1,398
ST-076	A2	BNSF Allensworth	8	2,584	Residential	62	58	63	2	None	747	2,278
ST-077	A2	BNSF Allensworth	14	2,017	Residential	51	60	60	9	Moderate	1,862	6,613
ST-078	A2	BNSF Allensworth	12	855	Residential	66	64	68	2	Moderate	487	1,398
ST-079	A2	BNSF Allensworth	12	1,185	Residential	69	62	70	1	None	327	908
ST-080	A2	BNSF Allensworth	10	1,497	Residential	65	61	66	2	Moderate	542	1,593
ST-081	A2	BNSF Allensworth	10	183	Residential	71	72	74	3	Severe	227	648
ST-082	A2	BNSF Allensworth	10	214	Residential	65	71	72	7	Severe	507	1,468
ST-085	A2	BNSF Allensworth	8	3,501	Residential	60	57	61	2	None	892	2,773
ST-086	A2	BNSF Allensworth	8	2,006	Residential	61	59	63	2	Moderate	797	2,438
ST-087	A2	BNSF Allensworth	8	6,112	Residential	70	54	70	0	None	257	688
ST-088	A2	BNSF Allensworth	8	7,445	Residential	64	53	64	0	None	602	1,773
4F-006	A2	BNSF Allensworth	19	274	Institutional	66	70	71	6	Moderate	197	568
4F-007	A2	BNSF Allensworth	13	10,548	Institutional	66	52	66	0	None	187	538
4F-008	A2	BNSF Allensworth	12	318	Institutional	65	69	70	5	Moderate	197	568
4F-009	A2	BNSF Allensworth	10	130	Institutional	69	73	75	6	Moderate	127	338
4F-010	A2	BNSF Allensworth	14	184	Institutional	69	72	74	5	Moderate	127	348
4F-045	A2	BNSF Allensworth	37	273	Institutional	64	70	71	6	Moderate	191	696
HP-063	A2	BNSF Allensworth	6	250	Institutional	69	70	72	4	Moderate	122	333

Table 6-16
Operational Noise Levels and Contours – Allensworth Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-026	A1	Allensworth Bypass	32	860	Residential	72	64	73	1	None	186	701
LT-027	A1	Allensworth Bypass	33	2,138	Residential	62	60	64	2	Moderate	786	2,401
LT-028	A1	Allensworth Bypass	8	5,918	Residential	67	54	67	0	None	382	1,073
LT-029	A1	Allensworth Bypass	7	7,712	Residential	74	53	74	0	None	157	628
LT-030	A1	Allensworth Bypass	7	7,023	Residential	72	53	72	0	None	192	623
LT-044	A1	Allensworth Bypass	9	14,865	Residential	66	50	66	0	None	472	1,363
LT-045	A1	Allensworth Bypass	8	13,832	Residential	71	50	71	0	None	217	638
LT-046	A1	Allensworth Bypass	8	11,551	Residential	73	51	73	0	None	172	633
LT-047	A1	Allensworth Bypass	8	8,895	Residential	60	52	61	1	None	887	2,748
LT-048	A1	Allensworth Bypass	6	10,433	Residential	76	51	76	0	None	107	618
LT-049	A1	Allensworth Bypass	6	9,177	Residential	65	52	65	0	None	522	1,523
LT-050	A1	Allensworth Bypass	6	8,796	Residential	62	52	62	0	None	697	2,108
LT-051	A1	Allensworth Bypass	6	8,086	Residential	69	53	69	0	None	312	863
LT-056	A1	Allensworth Bypass	9	10,518	Residential	62	51	62	0	None	752	2,283
LT-057	A1	Allensworth Bypass	8	7,491	Residential	59	53	60	1	None	977	3,078
ST-041	A1	Allensworth Bypass	9	29	Residential	72	81	82	9	Severe	192	643
ST-042	A1	Allensworth Bypass	10	2,413	Residential	70	58	70	0	None	287	778
ST-043	A1	Allensworth Bypass	32	1,555	Residential	55	61	62	7	Moderate	1,526	5,091
ST-044	A1	Allensworth Bypass	33	3,364	Residential	55	57	59	4	Moderate	1,496	4,971
ST-045	A1	Allensworth Bypass	9	7,345	Residential	66	53	66	0	None	467	1,338
ST-046	A1	Allensworth Bypass	9	5,502	Residential	67	54	67	0	None	402	1,133
ST-047	A1	Allensworth Bypass	7	7,835	Residential	70	53	70	0	None	267	718
ST-048	A1	Allensworth Bypass	6	8,577	Residential	65	52	65	0	None	502	1,453
ST-071	A1	Allensworth Bypass	9	13,001	Residential	67	50	67	0	None	412	1,163
ST-072	A1	Allensworth Bypass	8	8,557	Residential	65	52	66	0	None	482	1,383
ST-073	A1	Allensworth Bypass	8	10,288	Residential	72	51	72	0	None	197	638
ST-074	A1	Allensworth Bypass	9	9,690	Residential	67	52	67	0	None	402	1,133
ST-075	A1	Allensworth Bypass	7	14,679	Residential	65	50	65	0	None	482	1,383
ST-076	A1	Allensworth Bypass	9	10,781	Residential	62	51	62	0	None	757	2,298
ST-077	A1	Allensworth Bypass	6	8,294	Residential	51	52	55	4	None	1,717	6,148
ST-078	A1	Allensworth Bypass	7	10,440	Residential	66	51	66	0	None	462	1,333
ST-079	A1	Allensworth Bypass	6	8,762	Residential	69	52	69	0	None	312	853
ST-080	A1	Allensworth Bypass	5	7,868	Residential	65	53	65	0	None	522	1,513
ST-081	A1	Allensworth Bypass	6	8,060	Residential	71	53	71	0	None	222	623
ST-082	A1	Allensworth Bypass	6	8,461	Residential	65	52	65	0	None	487	1,408
ST-085	A1	Allensworth Bypass	8	6,219	Residential	60	54	61	1	None	892	2,773
ST-086	A1	Allensworth Bypass	8	7,688	Residential	61	53	62	1	None	797	2,438
ST-087	A1	Allensworth Bypass	7	7,534	Residential	70	53	70	0	None	252	683
ST-088	A1	Allensworth Bypass	7	4,699	Residential	64	55	64	1	None	592	1,753

Table 6-16
Operational Noise Levels and Contours – Allensworth Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
4F-006	A1	Allensworth Bypass	10	14,494	Institutional	66	50	66	0	None	187	518
4F-007	A1	Allensworth Bypass	7	3,420	Institutional	66	57	66	1	None	182	503
4F-008	A1	Allensworth Bypass	6	8,839	Institutional	65	52	65	0	None	192	533
4F-009	A1	Allensworth Bypass	6	8,055	Institutional	69	53	69	0	None	122	333
4F-010	A1	Allensworth Bypass	6	7,502	Institutional	69	53	69	0	None	122	333
4F-045	A1	Allensworth Bypass	33	1,491	Institutional	64	61	66	2	None	201	666
HP-062	A1	Allensworth Bypass	8	5,825	Institutional	65	54	65	0	None	207	588

Table 6-17
Noise Impacts – BNSF Alternative Alignment Through Allensworth*

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	900	30	0	0	0	1	4
Moderate	1,700	33	1	0	0	1	0
*Sites 4F-6 through 4F-8 are the same historic site, but modeled at different locations within the site. The site is only counted once at its closest distance							

Table 6-18
Noise Impacts – Allensworth Bypass Alternative*

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	900	0	0	0	0	0	1
Moderate	1,700	2	0	0	0	0	1
*Sites 4F-6 through 4F-8 are the same historic site, but modeled at different locations within the site. The site is only counted once at its closest distance							

6.2.6 BNSF Alternative Alignment through Wasco-Shafter

This portion of the project alignment extends from just northwest of Whisler Road to southwest of the intersection of Hageman Road and Rosedale Lane. The elevation of the BNSF Alternative

Alignment through Wasco and Shafter will range from at-grade to approximately 75 feet above ground level. The line will be elevated to a height of approximately 75 feet as it crosses Highway 43 and the BNSF Railroad in Wasco. The line will return to grade level between Wasco and Shafter. Approaching Shafter, the line will again be elevated to a height ranging from 50 to 75 feet, and will remain elevated to the south end of the segment. The Wasco-Shafter Bypass Alignment will be going to the east of Wasco and Shafter and will primarily be at-grade and elevated to a height of approximately 10 feet above the existing grade. The two exceptions to this will be at the grade separations at Highway 43 and again at 7th Standard Road. At these locations, the alignment will be elevated on overpasses to a height of 70 to 75 feet above grade. There are 91 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 45 to 83 dBA Ldn, and the project noise levels at these sites range from 51 to 80 dBA Ldn. The impacts for the BNSF Alternative Alignment through Wasco and Shafter and the Wasco-Shafter Bypass are listed in Tables 6-19 and 6-20, respectively.

The increase in noise level along the BNSF Alternative Alignment through Wasco and Shafter would be as high as 12 dBA Ldn at one of the quietest locations where the noise impacts were analyzed. The increase in noise level along the Wasco-Shafter Bypass alternative would be as high as 16 dBA Ldn at a couple of the noise-sensitive receivers. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Tables 6-19 and 6-20, respectively.

The number of noise-sensitive land uses located within these impact contours were counted for the BNSF Alternative Alignment through Wasco-Shafter and the Wasco-Shafter Bypass Alternative, and the results are presented in Tables 6-21 and 6-22, respectively. Noise mitigation measures will need to be considered for both of these project alignments.

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-009a	WS4	BNSF Wasco-Shafter	5	1,021	Residential	60	62	64	4	Moderate	852	2,643
LT-009b	WS4	BNSF Wasco-Shafter	5	901	Residential	60	63	65	5	Moderate	852	2,643
LT-009	WS4	BNSF Wasco-Shafter	7	679	Residential	65	65	68	3	Moderate	492	1,423
LT-010	WS4	BNSF Wasco-Shafter	5	1,061	Residential	60	62	64	5	Moderate	887	2,778
LT-011a	WS4	BNSF Wasco-Shafter	7	621	Residential	65	65	68	3	Moderate	527	1,548
LT-011	WS4	BNSF Wasco-Shafter	8	14	Residential	79	76	81	2	Severe	92	633

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-012	WS4	BNSF Wasco-Shafter	8	84	Residential	73	76	77	5	Severe	182	633
LT-013	WS4	BNSF Wasco-Shafter	5	171	Residential	74	72	76	2	Moderate	137	618
LT-014	WS4	BNSF Wasco-Shafter	32	172	Residential	79	71	80	1	Moderate	91	696
LT-015a	WS4	BNSF Wasco-Shafter	67	873	Residential	64	66	68	4	Severe	1,066	3,641
LT-015	WS4	BNSF Wasco-Shafter	67	544	Residential	70	68	72	2	Moderate	341	1,516
LT-016a	WS4	BNSF Wasco-Shafter	19	681	Residential	64	65	68	4	Moderate	632	1,873
LT-016b	WS4	BNSF Wasco-Shafter	23	686	Residential	61	65	66	5	Severe	796	2,441
LT-016	WS4	BNSF Wasco-Shafter	18	236	Residential	75	71	76	1	Moderate	137	698
LT-017	WS4	BNSF Wasco-Shafter	10	240	Residential	79	70	80	0	Moderate	92	643
LT-018	WS4	BNSF Wasco-Shafter	9	332	Residential	73	68	74	1	Moderate	182	643
LT-019	WS4	BNSF Wasco-Shafter	27	184	Residential	73	71	75	2	Moderate	161	666
LT-020	WS4	BNSF Wasco-Shafter	38	630	Residential	60	66	67	7	Severe	1,051	3,306
LT-021	WS4	BNSF Wasco-Shafter	39	3,092	Residential	59	58	61	3	Moderate	1,201	3,846
LT-022	WS4	BNSF Wasco-Shafter	40	20	Residential	73	65	74	1	None	126	771
LT-023	WS4	BNSF Wasco-Shafter	38	1,557	Residential	73	61	74	0	None	121	746
LT-024	WS4	BNSF Wasco-Shafter	8	1,219	Residential	63	62	65	2	Moderate	632	1,893
LT-025	WS4	BNSF Wasco-Shafter	9	1,454	Residential	63	61	65	2	Moderate	667	1,988
LT-031	WS4	BNSF Wasco-Shafter	58	1,651	Residential	71	63	72	1	None	206	1,021
LT-032	WS4	BNSF Wasco-Shafter	70	1,777	Residential	64	64	67	3	Moderate	1,081	3,726
LT-033	WS4	BNSF Wasco-Shafter	70	3,496	Residential	67	61	68	1	None	661	2,436
LT-034	WS4	BNSF Wasco-Shafter	70	5,377	Residential	67	59	67	1	None	746	2,661
LT-035	WS4	BNSF Wasco-Shafter	68	3,457	Residential	59	61	63	4	Moderate	1,946	6,941
LT-036	WS4	BNSF Wasco-Shafter	69	4,451	Residential	61	60	64	2	Moderate	1,576	5,571

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-037	WS4	BNSF Wasco-Shafter	42	4,427	Residential	59	57	61	2	None	1,271	4,106
LT-038	WS4	BNSF Wasco-Shafter	13	4,171	Residential	60	56	61	2	None	967	3,018
LT-039	WS4	BNSF Wasco-Shafter	15	6,160	Residential	69	54	69	0	None	317	868
LT-040	WS4	BNSF Wasco-Shafter	9	3,736	Residential	59	56	61	2	None	962	3,023
LT-041	WS4	BNSF Wasco-Shafter	14	3,456	Residential	58	57	61	2	None	1,087	3,448
LT-042	WS4	BNSF Wasco-Shafter	13	6,093	Residential	62	54	62	1	None	777	2,368
LT-043	WS4	BNSF Wasco-Shafter	14	7,680	Residential	54	53	56	3	None	1,597	5,428
LT-145	WS4	BNSF Wasco-Shafter	5	8,567	Residential	57	52	58	1	None	1,102	3,573
LT-146	WS4	BNSF Wasco-Shafter	10	11,905	Residential	55	51	57	1	None	1,357	4,518
LT-147	WS4	BNSF Wasco-Shafter	6	9,318	Residential	58	52	59	1	None	1,057	3,378
LT-148	WS4	BNSF Wasco-Shafter	10	2,800	Residential	61	58	63	2	None	772	2,353
LT-149	WS4	BNSF Wasco-Shafter	43	5,656	Residential	55	56	58	3	Moderate	1,761	5,946
ST-014b	WS4	BNSF Wasco-Shafter	5	1,079	Residential	64	62	66	2	Moderate	547	1,598
ST-016	WS4	BNSF Wasco-Shafter	6	3,904	Institutional	59	56	61	2	None	367	1,118
ST-017	WS4	BNSF Wasco-Shafter	5	44	Institutional	78	79	82	3	Moderate	77	238
ST-018	WS4	BNSF Wasco-Shafter	6	36	Residential	83	80	85	2	Severe	92	623
ST-019	WS4	BNSF Wasco-Shafter	25	1,237	Residential	61	62	65	3	Moderate	796	2,431
ST-020	WS4	BNSF Wasco-Shafter	15	288	Residential	67	69	71	4	Severe	402	1,143
ST-021	WS4	BNSF Wasco-Shafter	70	957	Residential	66	66	69	3	Moderate	866	3,031
ST-022a	WS4	BNSF Wasco-Shafter	68	871	Residential	64	67	68	4	Severe	1,091	3,746
ST-022	WS4	BNSF Wasco-Shafter	68	937	Residential	67	66	69	3	Moderate	701	2,496
ST-023c	WS4	BNSF Wasco-Shafter	68	832	Residential	64	67	69	5	Severe	1,091	3,746
ST-023	WS4	BNSF Wasco-Shafter	66	255	Residential	70	70	73	3	Severe	336	1,481

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-024	WS4	BNSF Wasco-Shafter	56	1,987	Institutional	68	62	69	1	None	91	466
ST-025	WS4	BNSF Wasco-Shafter	10	3,612	Residential	48	57	57	9	Moderate	2,077	7,858
ST-026	WS4	BNSF Wasco-Shafter	9	223	Residential	73	70	75	2	Moderate	182	643
ST-027a	WS4	BNSF Wasco-Shafter	14	842	Residential	64	64	67	3	Moderate	602	1,773
ST-027	WS4	BNSF Wasco-Shafter	14	319	Residential	73	69	74	2	Moderate	197	668
ST-028a	WS4	BNSF Wasco-Shafter	40	879	Residential	64	64	67	3	Moderate	686	2,071
ST-028	WS4	BNSF Wasco-Shafter	44	693	Institutional	71	66	72	1	None	91	256
ST-029	WS4	BNSF Wasco-Shafter	16	1,397	Residential	64	61	66	2	Moderate	582	1,723
ST-030	WS4	BNSF Wasco-Shafter	30	472	Residential	69	67	71	2	Moderate	316	901
ST-031	WS4	BNSF Wasco-Shafter	10	504	Residential	69	66	71	2	Moderate	322	893
ST-032	WS4	BNSF Wasco-Shafter	39	2,540	Institutional	62	59	64	2	None	296	991
ST-033	WS4	BNSF Wasco-Shafter	38	2,246	Residential	48	60	60	12	Severe	2,466	9,301
ST-034	WS4	BNSF Wasco-Shafter	41	587	Residential	71	66	72	1	Moderate	231	776
ST-035	WS4	BNSF Wasco-Shafter	44	294	Institutional	69	69	72	3	Moderate	91	346
ST-036	WS4	BNSF Wasco-Shafter	49	1,873	Institutional	67	62	68	1	None	91	586
ST-037	WS4	BNSF Wasco-Shafter	39	1,713	Residential	58	61	63	5	Moderate	1,311	4,246
ST-038	WS4	BNSF Wasco-Shafter	41	1,889	Institutional	67	61	68	1	None	91	476
ST-039	WS4	BNSF Wasco-Shafter	35	2,593	Institutional	63	59	64	1	None	246	811
ST-040	WS4	BNSF Wasco-Shafter	18	1,181	Residential	66	62	67	2	Moderate	517	1,498
ST-049	WS4	BNSF Wasco-Shafter	4	7,526	Residential	45	53	54	8	Moderate	2,142	8,723
ST-050	WS4	BNSF Wasco-Shafter	5	8,692	Residential	47	52	53	6	None	2,047	7,958
ST-051	WS4	BNSF Wasco-Shafter	43	4,358	Residential	66	57	66	0	None	546	1,651
ST-052	WS4	BNSF Wasco-Shafter	62	3,775	Residential	50	59	60	10	Moderate	3,611	14,026

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-053	WS4	BNSF Wasco-Shafter	68	7,546	Residential	61	57	63	1	None	1,551	5,436
ST-054	WS4	BNSF Wasco-Shafter	37	7,407	Residential	66	54	67	0	None	486	1,431
ST-055	WS4	BNSF Wasco-Shafter	68	2,837	Residential	62	61	65	3	Moderate	1,401	4,886
ST-056	WS4	BNSF Wasco-Shafter	68	3,541	Residential	62	60	64	2	Moderate	1,401	4,886
ST-057	WS4	BNSF Wasco-Shafter	68	8,380	Residential	62	57	63	1	None	1,401	4,886
ST-058	WS4	BNSF Wasco-Shafter	29	5,125	Residential	62	55	63	1	None	751	2,286
ST-059	WS4	BNSF Wasco-Shafter	20	5,897	Residential	64	54	65	0	None	546	1,611
ST-060	WS4	BNSF Wasco-Shafter	14	5,175	Residential	58	55	59	2	None	1,177	3,788
ST-061	WS4	BNSF Wasco-Shafter	14	1,782	Residential	53	60	61	8	Moderate	1,697	5,868
ST-062	WS4	BNSF Wasco-Shafter	29	1,220	Residential	61	62	65	3	Moderate	821	2,516
ST-063	WS4	BNSF Wasco-Shafter	43	242	Residential	74	70	76	1	Moderate	91	796
ST-064	WS4	BNSF Wasco-Shafter	13	8,056	Residential	66	53	66	0	None	492	1,413
ST-065	WS4	BNSF Wasco-Shafter	24	2,513	Residential	59	58	61	3	Moderate	1,021	3,246
ST-066	WS4	BNSF Wasco-Shafter	14	7,581	Residential	51	53	55	4	None	1,852	6,563
ST-067	WS4	BNSF Wasco-Shafter	14	6,285	Residential	62	54	62	1	None	777	2,358
ST-068	WS4	BNSF Wasco-Shafter	10	4,691	Residential	59	55	61	1	None	972	3,053
ST-069	WS4	BNSF Wasco-Shafter	11	3,404	Residential	67	57	67	0	None	427	1,208
ST-070	WS4	BNSF Wasco-Shafter	17	8,548	Residential	66	53	66	0	None	492	1,423
ST-141	WS4	BNSF Wasco-Shafter	3	7,649	Residential	54	53	56	2	None	1,412	4,823
ST-142	WS4	BNSF Wasco-Shafter	8	9,478	Residential	68	52	68	0	None	337	938
ST-143	WS4	BNSF Wasco-Shafter	44	5,492	Residential	62	56	63	1	None	871	2,706
4F-002	WS4	BNSF Wasco-Shafter	69	3,955	Institutional	61	60	64	2	None	391	1,826
4F-023a	WS4	BNSF Wasco-Shafter	68	619	Institutional	68	68	71	3	None	91	596

Table 6-19
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Wasco-Shafter

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
4F-032	WS4	BNSF Wasco-Shafter	60	603	Institutional	70	67	72	2	None	91	366
4F-036	WS4	BNSF Wasco-Shafter	68	561	Institutional	70	68	72	2	None	91	396
4F-047	WS4	BNSF Wasco-Shafter	43	737	Institutional	71	66	72	1	None	91	256
4F-049	WS4	BNSF Wasco-Shafter	43	133	Institutional	74	72	76	2	Moderate	91	246
4F-050	WS4	BNSF Wasco-Shafter	36	4,007	Institutional	62	57	63	1	None	281	926
4F-051	WS4	BNSF Wasco-Shafter	57	2,040	Institutional	68	62	69	1	None	91	476
4F-052	WS4	BNSF Wasco-Shafter	9	6,433	Institutional	62	54	62	1	None	287	848
4F-055	WS4	BNSF Wasco-Shafter	65	764	Institutional	70	67	71	2	None	91	386
4F-057	WS4	BNSF Wasco-Shafter	68	5,836	Institutional	60	58	62	2	None	511	2,136
HP-052	WS4	BNSF Wasco-Shafter	44	120	Institutional	71	72	75	4	Moderate	91	236
HP-053	WS4	BNSF Wasco-Shafter	66	100	Institutional	71	71	74	3	Moderate	91	236
HP-059	WS4	BNSF Wasco-Shafter	9	5,750	Institutional	59	54	60	1	None	372	1,123
HP-061	WS4	BNSF Wasco-Shafter	69	2,860	Institutional	67	62	68	1	None	91	736

Table 6-20
Operational Noise Levels and Contours – Wasco-Shafter Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-009a	WS2	Wasco-Shafter Bypass	6	1,139	Residential	60	62	64	4	Moderate	857	2,658
LT-009b	WS2	Wasco-Shafter Bypass	5	1,019	Residential	60	62	64	4	Moderate	852	2,643
LT-009	WS2	Wasco-Shafter Bypass	6	798	Residential	65	64	68	2	Moderate	487	1,408
LT-010	WS2	Wasco-Shafter Bypass	6	943	Residential	60	63	65	5	Moderate	897	2,798
LT-011a	WS2	Wasco-Shafter Bypass	73	739	Residential	65	67	69	5	Severe	1,116	3,871
LT-011	WS2	Wasco-Shafter Bypass	67	132	Residential	79	71	79	1	Moderate	91	1,226
LT-012	WS2	Wasco-Shafter Bypass	60	235	Residential	73	70	75	2	Moderate	91	1,056
LT-013	WS2	Wasco-Shafter Bypass	6	2,202	Residential	74	59	75	0	None	142	623
LT-014	WS2	Wasco-Shafter Bypass	3	2,606	Residential	79	58	79	0	None	92	613
LT-015a	WS2	Wasco-Shafter Bypass	7	6,633	Residential	64	53	64	0	None	562	1,643
LT-015	WS2	Wasco-Shafter Bypass	7	6,284	Residential	70	54	70	0	None	277	758
LT-016a	WS2	Wasco-Shafter Bypass	9	7,802	Residential	64	53	64	0	None	572	1,683
LT-016b	WS2	Wasco-Shafter Bypass	8	7,690	Residential	61	53	62	1	None	787	2,408
LT-016	WS2	Wasco-Shafter Bypass	8	7,435	Residential	75	53	75	0	None	132	633
LT-017	WS2	Wasco-Shafter Bypass	7	8,663	Residential	79	52	79	0	None	92	623
LT-018	WS2	Wasco-Shafter Bypass	7	10,657	Residential	73	51	73	0	None	182	623
LT-019	WS2	Wasco-Shafter Bypass	8	9,683	Residential	73	52	73	0	None	177	638
LT-020	WS2	Wasco-Shafter Bypass	11	7,311	Residential	60	53	61	1	None	907	2,808
LT-021	WS2	Wasco-Shafter Bypass	11	5,090	Residential	59	55	60	2	None	1,017	3,218
LT-022	WS2	Wasco-Shafter Bypass	8	6,805	Residential	73	53	73	0	None	167	638
LT-023	WS2	Wasco-Shafter Bypass	8	2,147	Residential	73	59	74	0	None	162	633
LT-024	WS2	Wasco-Shafter Bypass	9	3,009	Residential	63	57	64	1	None	642	1,903
LT-025	WS2	Wasco-Shafter Bypass	33	1,441	Residential	63	62	65	2	Moderate	736	2,231
LT-031	WS2	Wasco-Shafter Bypass	3	1,770	Residential	71	60	71	0	None	222	613

Table 6-20
Operational Noise Levels and Contours – Wasco-Shafter Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-032	WS2	Wasco-Shafter Bypass	4	2,622	Residential	64	58	65	1	None	522	1,523
LT-033	WS2	Wasco-Shafter Bypass	6	1,421	Residential	67	61	68	1	None	377	1,058
LT-034	WS2	Wasco-Shafter Bypass	5	829	Residential	67	64	68	2	Moderate	402	1,133
LT-035	WS2	Wasco-Shafter Bypass	8	2,415	Residential	59	58	62	3	Moderate	932	2,913
LT-036	WS2	Wasco-Shafter Bypass	6	641	Residential	61	65	66	5	Severe	747	2,268
LT-037	WS2	Wasco-Shafter Bypass	8	2,168	Residential	59	59	62	3	Moderate	1,002	3,173
LT-038	WS2	Wasco-Shafter Bypass	7	3,458	Residential	60	57	61	2	None	907	2,838
LT-039	WS2	Wasco-Shafter Bypass	7	1,440	Residential	69	61	70	1	None	292	803
LT-040	WS2	Wasco-Shafter Bypass	8	4,953	Residential	59	55	61	1	None	952	3,003
LT-041	WS2	Wasco-Shafter Bypass	8	4,656	Residential	58	55	60	2	None	1,022	3,243
LT-042	WS2	Wasco-Shafter Bypass	7	2,172	Residential	62	59	63	2	Moderate	737	2,228
LT-043	WS2	Wasco-Shafter Bypass	8	239	Residential	54	70	70	16	Severe	1,502	5,123
LT-145	WS2	Wasco-Shafter Bypass	6	7,122	Residential	57	53	59	1	None	1,112	3,603
LT-146	WS2	Wasco-Shafter Bypass	7	1,873	Residential	55	60	61	6	Moderate	1,322	4,393
LT-147	WS2	Wasco-Shafter Bypass	68	9,200	Residential	58	56	60	2	None	2,291	8,316
LT-148	WS2	Wasco-Shafter Bypass	9	293	Residential	61	69	70	8	Severe	767	2,338
LT-149	WS2	Wasco-Shafter Bypass	10	581	Residential	55	66	66	11	Severe	1,382	4,613
ST-014b	WS2	Wasco-Shafter Bypass	5	1,197	Residential	64	62	66	2	Moderate	547	1,598
ST-016	WS2	Wasco-Shafter Bypass	5	3,786	Institutional	59	56	61	2	None	367	1,108
ST-017	WS2	Wasco-Shafter Bypass	64	162	Institutional	78	71	79	1	Moderate	91	246
ST-018	WS2	Wasco-Shafter Bypass	69	155	Residential	83	71	83	0	Moderate	91	1,276
ST-019	WS2	Wasco-Shafter Bypass	3	1,435	Residential	61	61	64	3	Moderate	742	2,263
ST-020	WS2	Wasco-Shafter Bypass	5	2,628	Residential	67	58	68	0	None	367	1,038
ST-021	WS2	Wasco-Shafter Bypass	4	3,649	Residential	66	56	66	0	None	442	1,263
ST-022a	WS2	Wasco-Shafter Bypass	7	6,415	Residential	64	54	64	0	None	562	1,643

Table 6-20
Operational Noise Levels and Contours – Wasco-Shafter Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-022	WS2	Wasco-Shafter Bypass	6	6,365	Residential	67	54	67	0	None	402	1,133
ST-023c	WS2	Wasco-Shafter Bypass	7	4,820	Residential	64	55	65	1	None	562	1,643
ST-023	WS2	Wasco-Shafter Bypass	8	5,614	Residential	70	54	70	0	None	282	763
ST-024	WS2	Wasco-Shafter Bypass	9	4,241	Institutional	68	56	69	0	None	132	353
ST-025	WS2	Wasco-Shafter Bypass	7	7,209	Residential	48	53	54	6	Moderate	2,017	7,668
ST-026	WS2	Wasco-Shafter Bypass	8	9,823	Residential	73	52	73	0	None	182	633
ST-027a	WS2	Wasco-Shafter Bypass	8	8,833	Residential	64	52	64	0	None	567	1,668
ST-027	WS2	Wasco-Shafter Bypass	8	8,275	Residential	73	52	73	0	None	187	638
ST-028a	WS2	Wasco-Shafter Bypass	9	7,415	Residential	64	53	64	0	None	572	1,683
ST-028	WS2	Wasco-Shafter Bypass	9	7,134	Institutional	71	53	71	0	None	97	248
ST-029	WS2	Wasco-Shafter Bypass	7	5,904	Residential	64	54	65	0	None	537	1,568
ST-030	WS2	Wasco-Shafter Bypass	12	9,821	Residential	69	52	69	0	None	312	863
ST-031	WS2	Wasco-Shafter Bypass	10	9,820	Residential	69	52	69	0	None	322	893
ST-032	WS2	Wasco-Shafter Bypass	9	9,452	Institutional	62	52	62	0	None	282	833
ST-033	WS2	Wasco-Shafter Bypass	8	9,883	Residential	48	52	53	5	None	2,037	7,728
ST-034	WS2	Wasco-Shafter Bypass	8	4,680	Residential	71	55	71	0	None	237	628
ST-035	WS2	Wasco-Shafter Bypass	10	4,598	Institutional	69	55	69	0	None	117	308
ST-036	WS2	Wasco-Shafter Bypass	10	6,826	Institutional	67	54	67	0	None	162	453
ST-037	WS2	Wasco-Shafter Bypass	7	5,702	Residential	58	54	59	2	None	1,067	3,418
ST-038	WS2	Wasco-Shafter Bypass	8	6,020	Institutional	67	54	68	0	None	147	398
ST-039	WS2	Wasco-Shafter Bypass	8	6,185	Institutional	63	54	64	1	None	247	708
ST-040	WS2	Wasco-Shafter Bypass	9	3,795	Residential	66	56	66	0	None	472	1,363
ST-049	WS2	Wasco-Shafter Bypass	4	5,332	Residential	45	54	55	10	Moderate	2,142	8,723
ST-050	WS2	Wasco-Shafter Bypass	6	7,220	Residential	47	53	54	7	Moderate	2,067	8,018
ST-051	WS2	Wasco-Shafter Bypass	8	2,289	Residential	66	59	67	1	None	447	1,278

Table 6-20
Operational Noise Levels and Contours – Wasco-Shafter Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-052	WS2	Wasco-Shafter Bypass	9	2,363	Residential	50	59	59	9	Moderate	1,887	6,878
ST-053	WS2	Wasco-Shafter Bypass	9	1,612	Residential	61	60	64	3	Moderate	772	2,353
ST-054	WS2	Wasco-Shafter Bypass	8	559	Residential	66	66	69	3	Moderate	422	1,203
ST-055	WS2	Wasco-Shafter Bypass	9	2,922	Residential	62	57	63	1	None	707	2,138
ST-056	WS2	Wasco-Shafter Bypass	7	1,856	Residential	62	60	64	2	Moderate	697	2,098
ST-057	WS2	Wasco-Shafter Bypass	8	2,616	Residential	62	58	64	1	None	702	2,113
ST-058	WS2	Wasco-Shafter Bypass	7	1,931	Residential	62	59	64	2	Moderate	697	2,098
ST-059	WS2	Wasco-Shafter Bypass	7	1,464	Residential	64	61	66	2	Moderate	557	1,628
ST-060	WS2	Wasco-Shafter Bypass	7	2,932	Residential	58	57	60	3	Moderate	1,097	3,528
ST-061	WS2	Wasco-Shafter Bypass	8	6,319	Residential	53	54	56	4	None	1,597	5,538
ST-062	WS2	Wasco-Shafter Bypass	8	5,639	Residential	61	54	62	1	None	762	2,333
ST-063	WS2	Wasco-Shafter Bypass	9	6,254	Residential	74	54	74	0	None	147	638
ST-064	WS2	Wasco-Shafter Bypass	8	266	Residential	66	70	71	5	Severe	467	1,348
ST-065	WS2	Wasco-Shafter Bypass	8	4,553	Residential	59	55	60	2	None	1,002	3,173
ST-066	WS2	Wasco-Shafter Bypass	7	723	Residential	51	64	65	13	Severe	1,727	6,148
ST-067	WS2	Wasco-Shafter Bypass	7	1,886	Residential	62	60	64	2	Moderate	727	2,198
ST-068	WS2	Wasco-Shafter Bypass	7	3,825	Residential	59	56	61	2	None	947	2,968
ST-069	WS2	Wasco-Shafter Bypass	7	5,396	Residential	67	54	67	0	None	412	1,163
ST-070	WS2	Wasco-Shafter Bypass	8	882	Residential	66	63	68	2	Moderate	452	1,293
ST-141	WS2	Wasco-Shafter Bypass	5	5,473	Residential	54	54	57	3	None	1,427	4,878
ST-142	WS2	Wasco-Shafter Bypass	8	124	Residential	68	74	75	6	Severe	337	938
ST-143	WS2	Wasco-Shafter Bypass	8	1,121	Residential	62	62	65	3	Moderate	677	2,038
4F-002	WS2	Wasco-Shafter Bypass	6	1,233	Institutional	61	62	65	3	None	287	848
4F-023a	WS2	Wasco-Shafter Bypass	7	6,266	Institutional	68	54	68	0	None	132	363
4F-032	WS2	Wasco-Shafter Bypass	8	6,686	Institutional	70	54	70	0	None	107	298

Table 6-20
Operational Noise Levels and Contours – Wasco-Shafter Bypass Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Exposure (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Increase Over Existing (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
4F-036	WS2	Wasco-Shafter Bypass	7	6,099	Institutional	70	54	70	0	None	107	288
4F-047	WS2	Wasco-Shafter Bypass	9	7,213	Institutional	71	53	71	0	None	97	248
4F-049	WS2	Wasco-Shafter Bypass	9	6,628	Institutional	74	54	74	0	None	77	248
4F-050	WS2	Wasco-Shafter Bypass	9	2,784	Institutional	62	58	63	1	None	272	803
4F-051	WS2	Wasco-Shafter Bypass	9	4,227	Institutional	68	56	69	0	None	132	353
4F-052	WS2	Wasco-Shafter Bypass	7	2,088	Institutional	62	59	64	2	None	282	833
4F-055	WS2	Wasco-Shafter Bypass	9	6,692	Institutional	70	54	70	0	None	112	293
4F-057	WS2	Wasco-Shafter Bypass	6	75	Institutional	60	76	76	16	Severe	332	993
HP-051	WS2	Wasco-Shafter Bypass	11	6,475	Institutional	71	54	71	0	None	92	243
HP-053	WS2	Wasco-Shafter Bypass	11	6,280	Institutional	71	54	71	0	None	92	243
HP-058	WS2	Wasco-Shafter Bypass	7	1,845	Institutional	62	60	64	2	None	282	833
HP-060	WS2	Wasco-Shafter Bypass	9	1,090	Institutional	61	62	65	4	None	297	868

Table 6-21
Noise Impacts – BNSF Alternative Alignment Through Wasco-Shafter

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,400	1,831	2	0	13	1	6
Moderate	3,000	2,624	8	0	10	1	2

Table 6-22
Noise Impacts – Wasco-Shafter Bypass Alternative

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,400	192	0	0	0	0	2
Moderate	2,700	330	1	0	3	0	1

6.2.7 BNSF Alternative Alignment Through Bakersfield

This portion of the project alignment extends from southwest of the intersection of Hageman Road and Rosedale Lane to the east end of the proposed stations within downtown Bakersfield. The BNSF Alternative Alignment through Bakersfield and the Bakersfield South Alternative will be elevated to a height ranging from 50 to 80 feet throughout this segment of the project alignment. There are 57 noise measurement sites located along this section of alignment which were used for noise impact modeling sites. The existing noise levels at these sites ranged from 54 to 80 dBA Ldn. The existing noise levels for the 4(f) and historical structure sites were interpolated from the short-term and long-term measurement data. The project noise levels at all of the sites for the BNSF Alternative Alignment through Bakersfield range from 56 to 92 dBA Ldn and the project noise levels for the Bakersfield South Alternative range from 57 to 92 dBA Ldn. The impacts for the BNSF Alternative Alignment through Bakersfield and the Bakersfield South Alternative are listed in Tables 6-23 and 6-24, respectively.

The increase in noise levels along both alternatives that go through Bakersfield would be as high as 15 dBA Ldn. The results of the analysis show there is a potential for moderate and severe noise impacts for most of the receivers along the project alignment. The distances from the project alignment to the location of the severe impact and moderate impact thresholds were calculated for each analysis site, and these results are also presented in Tables 6-23 and 6-24, respectively.

The number of noise-sensitive land uses located within these impact contours were counted for the BNSF Alternative Alignment through Bakersfield and the Bakersfield South Alternative, and the results are presented in Tables 6-25 and 6-26, respectively. Noise mitigation measures will need to be considered for both of these project alignments.

Table 6-23
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Bakersfield

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-001	B1	BNSF Bakersfield	50	279	Residential	65	70	71	6	Severe	726	2,261
LT-003	B1	BNSF Bakersfield	58	164	Residential	58	71	71	13	Severe	1,816	6,221
LT-004	B1	BNSF Bakersfield	10	134	Residential	72	73	75	4	Severe	217	648
LT-005	B1	BNSF Bakersfield	3	114	Residential	72	74	76	4	Severe	212	613
LT-006	B1	BNSF Bakersfield	3	59	Residential	74	77	79	5	Severe	147	608
LT-007	B1	BNSF Bakersfield	3	3	Residential	78	92	93	15	Severe	92	613
LT-008	B1	BNSF Bakersfield	5	482	Residential	69	66	71	2	Moderate	312	863
LT-159	B1	BNSF Bakersfield	38	124	Residential	63	72	73	9	Severe	741	2,266
LT-187	B1	BNSF Bakersfield	65	1,055	Residential	67	65	69	2	Moderate	646	2,271
LT-188	B1	BNSF Bakersfield	52	928	Residential	70	65	71	1	Moderate	311	1,106
LT-189	B1	BNSF Bakersfield	55	2,455	Residential	60	61	64	3	Moderate	1,296	4,251
LT-190	B1	BNSF Bakersfield	63	4,230	Residential	62	59	64	2	None	1,226	4,131
LT-191	B1	BNSF Bakersfield	50	3,195	Residential	69	59	69	0	None	381	1,276
LT-192	B1	BNSF Bakersfield	50	1,324	Residential	64	63	66	3	Moderate	811	2,536
LT-193	B1	BNSF Bakersfield	48	4,362	Residential	69	57	69	0	None	346	1,151
LT-194	B1	BNSF Bakersfield	39	5,243	Residential	65	56	65	1	None	626	1,881
LT-197	B1	BNSF Bakersfield	60	1,950	Residential	68	62	69	1	None	496	1,741
LT-198	B1	BNSF Bakersfield	67	3,682	Residential	71	60	72	0	None	211	1,226
LT-199	B1	BNSF Bakersfield	62	2,779	Residential	66	61	67	1	None	731	2,436
LT-200	B1	BNSF Bakersfield	39	3,487	Residential	64	58	65	1	None	696	2,101
ST-001	B1	BNSF Bakersfield	50	21	Institutional	69	64	70	1	None	91	376
ST-002	B1	BNSF Bakersfield	60	576	Residential	80	67	80	0	Moderate	91	1,056
ST-003a	B1	BNSF Bakersfield	65	976	Residential	62	66	67	5	Severe	1,311	4,476
ST-003	B1	BNSF Bakersfield	68	850	Residential	72	67	73	1	Moderate	91	1,246
ST-004a	B1	BNSF Bakersfield	70	1,160	Residential	61	66	67	6	Severe	1,646	5,821
ST-004	B1	BNSF Bakersfield	70	1,041	Institutional	71	66	72	1	None	91	256
ST-005a	B1	BNSF Bakersfield	44	857	Residential	63	65	67	4	Moderate	841	2,606
ST-005	B1	BNSF Bakersfield	46	335	Institutional	68	69	71	4	Moderate	91	476
ST-006	B1	BNSF Bakersfield	63	1,089	Institutional	69	65	70	2	None	91	456
ST-007	B1	BNSF Bakersfield	72	428	Residential	69	69	72	3	Severe	451	1,866
ST-008a	B1	BNSF Bakersfield	74	643	Residential	60	68	69	9	Severe	2,026	7,321
ST-008	B1	BNSF Bakersfield	74	93	Residential	71	70	74	2	Moderate	141	176
ST-008b	B1	BNSF Bakersfield	74	1,735	Residential	62	64	66	4	Moderate	1,691	6,026
ST-009	B1	BNSF Bakersfield	3	153	Residential	64	72	73	9	Severe	532	1,553
ST-010	B1	BNSF Bakersfield	7	371	Residential	69	68	71	3	Moderate	307	848
ST-011	B1	BNSF Bakersfield	10	486	Residential	54	66	67	12	Severe	1,467	4,958
ST-012	B1	BNSF Bakersfield	3	193	Residential	60	71	71	12	Severe	882	2,763
ST-013	B1	BNSF Bakersfield	4	576	Residential	76	65	76	0	Moderate	117	608

Table 6-23
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Bakersfield

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-015	B1	BNSF Bakersfield	4	326	Residential	78	68	79	0	Moderate	92	613
ST-160	B1	BNSF Bakersfield	39	84	Residential	63	73	73	10	Severe	781	2,386
ST-161	B1	BNSF Bakersfield	40	930	Residential	70	64	71	1	None	256	821
ST-164	B1	BNSF Bakersfield	39	1,357	Institutional	74	62	74	0	None	91	246
ST-190	B1	BNSF Bakersfield	60	1,822	Institutional	63	63	66	3	None	241	1,206
ST-191	B1	BNSF Bakersfield	74	912	Residential	76	67	76	1	Moderate	91	1,396
ST-192	B1	BNSF Bakersfield	74	2,101	Residential	66	63	68	2	Moderate	936	3,281
ST-193	B1	BNSF Bakersfield	55	2,788	Residential	67	60	68	1	None	561	1,816
ST-194	B1	BNSF Bakersfield	63	3,482	Residential	68	60	68	1	None	546	1,941
ST-195a	B1	BNSF Bakersfield	50	534	Residential	68	67	71	3	Moderate	451	1,446
ST-195	B1	BNSF Bakersfield	52	741	Residential	60	66	67	7	Severe	1,321	4,316
ST-196	B1	BNSF Bakersfield	48	3,744	Residential	66	58	66	1	None	606	1,871
ST-197	B1	BNSF Bakersfield	52	3,336	Residential	57	59	61	4	Moderate	1,821	6,176
ST-198	B1	BNSF Bakersfield	50	1,628	Residential	73	62	74	0	None	91	886
ST-199	B1	BNSF Bakersfield	40	4,583	Institutional	61	56	62	1	None	356	1,181
ST-200	B1	BNSF Bakersfield	38	5,304	Institutional	59	56	61	2	None	401	1,296
ST-202	B1	BNSF Bakersfield	39	3,001	Residential	57	58	61	4	Moderate	1,386	4,521
ST-203	B1	BNSF Bakersfield	72	1,654	Residential	69	64	70	1	Moderate	451	1,866
ST-204	B1	BNSF Bakersfield	72	3,666	Residential	70	61	70	0	None	316	1,601
4F-001	B1	BNSF Bakersfield	50	447	Institutional	65	68	70	5	Moderate	171	806
4F-003	B1	BNSF Bakersfield	50	387	Institutional	65	69	70	5	Moderate	171	806
4F-011	B1	BNSF Bakersfield	46	164	Institutional	68	71	73	5	Moderate	91	476
4F-013	B1	BNSF Bakersfield	50	490	Institutional	70	68	72	2	None	91	326
4F-014	B1	BNSF Bakersfield	50	1,330	Institutional	68	63	69	1	None	91	486
4F-015	B1	BNSF Bakersfield	52	204	Institutional	69	70	73	4	Moderate	91	386
4F-020	B1	BNSF Bakersfield	45	1,747	Institutional	57	62	63	6	Moderate	546	1,821
4F-027	B1	BNSF Bakersfield	50	894	Institutional	68	65	70	2	None	91	496
4F-028	B1	BNSF Bakersfield	63	1,047	Institutional	67	65	69	2	None	91	706
4F-037	B1	BNSF Bakersfield	70	1,009	Institutional	71	66	72	1	None	91	256
4F-041	B1	BNSF Bakersfield	39	1,398	Institutional	74	62	74	0	None	91	246
4F-046	B1	BNSF Bakersfield	50	1,728	Institutional	64	62	66	2	None	201	906
4F-058	B1	BNSF Bakersfield	81	771	Institutional	67	68	70	4	Moderate	91	1,006
HP-034	B1	BNSF Bakersfield	53	162	Institutional	66	71	72	6	Moderate	91	686
HP-035	B1	BNSF Bakersfield	52	400	Institutional	66	69	70	4	Moderate	91	676
HP-036	B1	BNSF Bakersfield	52	25	Residential	66	64	68	2	Moderate	611	1,926
HP-037	B1	BNSF Bakersfield	53	309	Residential	66	69	71	5	Severe	621	1,966
HP-038	B1	BNSF Bakersfield	52	326	Institutional	66	69	71	5	Moderate	91	676
HP-039	B1	BNSF Bakersfield	51	507	Residential	64	68	69	5	Severe	816	2,571

Table 6-23
Operational Noise Levels and Contours – BNSF Alternative Alignment Through Bakersfield

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HP-040	B1	BNSF Bakersfield	52	773	Residential	64	66	68	4	Severe	831	2,616
HP-041	B1	BNSF Bakersfield	52	725	Residential	64	66	68	4	Severe	831	2,616
HP-042	B1	BNSF Bakersfield	52	616	Residential	63	67	68	6	Severe	961	3,066
HP-043	B1	BNSF Bakersfield	52	564	Residential	63	67	68	6	Severe	961	3,066
HP-044	B1	BNSF Bakersfield	52	510	Institutional	63	68	69	6	Moderate	266	1,091
HP-045	B1	BNSF Bakersfield	52	315	Institutional	65	69	71	6	Moderate	171	836
HP-046	B1	BNSF Bakersfield	52	260	Institutional	66	70	71	5	Moderate	91	676
HP-047	B1	BNSF Bakersfield	52	295	Institutional	65	70	71	6	Moderate	171	836
HP-048	B1	BNSF Bakersfield	52	605	Institutional	63	67	68	6	Moderate	266	1,091
HP-049	B1	BNSF Bakersfield	52	320	Institutional	65	69	71	6	Moderate	171	836
HP-070	B1	BNSF Bakersfield	75	47	Institutional	64	64	67	3	None	195	1,390

Table 6-24
Operational Noise Levels and Contours – Bakersfield South Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-001	B2	Bakersfield South	49	364	Residential	65	69	70	6	Severe	716	2,221
LT-003	B2	Bakersfield South	63	94	Residential	58	71	71	14	Severe	2,031	7,136
LT-004	B2	Bakersfield South	17	9	Residential	72	63	72	1	None	227	698
LT-005	B2	Bakersfield South	6	77	Residential	72	76	77	6	Severe	212	623
LT-006	B2	Bakersfield South	3	59	Residential	74	77	79	5	Severe	147	608
LT-007	B2	Bakersfield South	3	3	Residential	78	92	93	15	Severe	92	613
LT-008	B2	Bakersfield South	5	482	Residential	69	66	71	2	Moderate	312	863
LT-159	B2	Bakersfield South	40	950	Residential	63	64	67	3	Moderate	761	2,326
LT-187	B2	Bakersfield South	59	610	Residential	67	67	70	3	Moderate	586	1,971

Table 6-24
Operational Noise Levels and Contours – Bakersfield South Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
LT-188	B2	Bakersfield South	47	1,366	Residential	70	63	70	1	None	306	1,021
LT-189	B2	Bakersfield South	50	2,907	Residential	60	59	63	2	Moderate	1,186	3,821
LT-190	B2	Bakersfield South	56	4,684	Residential	62	58	64	1	None	1,071	3,476
LT-191	B2	Bakersfield South	47	3,528	Residential	69	58	69	0	None	376	1,211
LT-192	B2	Bakersfield South	49	1,339	Residential	64	63	66	3	Moderate	796	2,481
LT-193	B2	Bakersfield South	49	4,233	Residential	69	57	69	0	None	351	1,166
LT-194	B2	Bakersfield South	41	4,214	Residential	65	57	65	1	None	641	1,936
LT-197	B2	Bakersfield South	56	1,493	Residential	68	63	69	1	Moderate	471	1,596
LT-198	B2	Bakersfield South	60	3,243	Residential	71	60	72	0	None	201	1,056
LT-199	B2	Bakersfield South	56	2,323	Residential	66	61	67	1	None	666	2,131
LT-200	B2	Bakersfield South	41	4,478	Residential	64	57	65	1	None	711	2,166
ST-001	B2	Bakersfield South	47	444	Institutional	69	68	72	2	None	91	366
ST-002	B2	Bakersfield South	55	118	Residential	80	71	80	1	Moderate	91	966
ST-003a	B2	Bakersfield South	60	1,418	Residential	62	64	66	4	Moderate	1,181	3,916
ST-003	B2	Bakersfield South	62	1,285	Residential	72	64	73	1	None	116	1,101
ST-004a	B2	Bakersfield South	60	723	Residential	61	67	68	7	Severe	1,316	4,391
ST-004	B2	Bakersfield South	62	606	Institutional	71	68	73	2	None	91	236
ST-005a	B2	Bakersfield South	47	1,284	Residential	63	63	66	3	Moderate	881	2,746
ST-005	B2	Bakersfield South	49	538	Institutional	68	67	71	3	None	91	486
ST-006	B2	Bakersfield South	56	635	Institutional	69	67	71	2	None	91	426
ST-007	B2	Bakersfield South	79	731	Residential	69	68	71	2	Moderate	466	2,091
ST-008a	B2	Bakersfield South	82	987	Residential	60	67	68	8	Severe	2,211	8,056
ST-008	B2	Bakersfield South	80	421	Residential	71	69	73	2	Moderate	126	1,521
ST-008b	B2	Bakersfield South	82	2,086	Residential	62	64	66	4	Moderate	1,846	6,611
ST-009	B2	Bakersfield South	3	163	Residential	64	72	73	8	Severe	532	1,553
ST-010	B2	Bakersfield South	9	261	Residential	69	70	72	3	Severe	312	863
ST-011	B2	Bakersfield South	14	354	Residential	54	68	68	14	Severe	1,532	5,153
ST-012	B2	Bakersfield South	3	193	Residential	60	71	71	12	Severe	882	2,763
ST-013	B2	Bakersfield South	4	576	Residential	76	65	76	0	Moderate	117	608
ST-015	B2	Bakersfield South	4	326	Residential	78	68	79	0	Moderate	92	613
ST-160	B2	Bakersfield South	40	681	Residential	63	66	67	5	Severe	791	2,416
ST-161	B2	Bakersfield South	40	167	Residential	70	71	74	3	Severe	256	821
ST-164	B2	Bakersfield South	41	479	Institutional	74	67	75	1	None	91	246
ST-190	B2	Bakersfield South	56	2,279	Institutional	63	61	65	2	None	241	1,116
ST-191	B2	Bakersfield South	64	496	Residential	76	68	76	1	Moderate	91	1,146

Table 6-24
Operational Noise Levels and Contours – Bakersfield South Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
ST-192	B2	Bakersfield South	64	2,518	Residential	66	61	67	1	Moderate	781	2,626
ST-193	B2	Bakersfield South	49	3,235	Residential	67	59	67	1	None	521	1,626
ST-194	B2	Bakersfield South	56	3,936	Residential	68	59	68	1	None	496	1,671
ST-195a	B2	Bakersfield South	48	168	Residential	68	71	73	5	Severe	441	1,406
ST-195	B2	Bakersfield South	47	301	Residential	60	69	70	10	Severe	1,216	3,911
ST-196	B2	Bakersfield South	49	3,572	Residential	66	58	66	1	None	616	1,901
ST-197	B2	Bakersfield South	47	3,764	Residential	57	58	60	4	Moderate	1,666	5,571
ST-198	B2	Bakersfield South	47	1,937	Residential	73	61	74	0	None	91	846
ST-199	B2	Bakersfield South	41	3,804	Institutional	61	57	62	2	None	356	1,191
ST-200	B2	Bakersfield South	41	4,459	Institutional	59	57	61	2	None	411	1,356
ST-202	B2	Bakersfield South	41	3,987	Residential	57	57	60	3	Moderate	1,426	4,671
ST-203	B2	Bakersfield South	64	1,228	Residential	69	65	70	1	Moderate	401	1,566
ST-204	B2	Bakersfield South	64	3,241	Residential	70	60	70	0	None	296	1,341
4F-001	B2	Bakersfield South	47	229	Institutional	65	70	71	7	Moderate	171	776
4F-003	B2	Bakersfield South	49	401	Institutional	65	68	70	5	Moderate	171	796
4F-011	B2	Bakersfield South	48	392	Institutional	68	69	71	3	Moderate	91	486
4F-013	B2	Bakersfield South	49	896	Institutional	70	65	71	1	None	91	326
4F-014	B2	Bakersfield South	47	1,014	Institutional	68	64	69	2	None	91	476
4F-015	B2	Bakersfield South	47	229	Institutional	69	70	73	4	Moderate	91	366
4F-020	B2	Bakersfield South	45	2,076	Institutional	57	61	62	5	None	546	1,821
4F-027	B2	Bakersfield South	49	798	Institutional	68	66	70	2	None	91	486
4F-028	B2	Bakersfield South	57	596	Institutional	67	67	70	3	Moderate	91	646
4F-037	B2	Bakersfield South	62	579	Institutional	71	68	73	2	None	91	236
4F-041	B2	Bakersfield South	41	518	Institutional	74	67	75	1	None	91	246
4F-046	B2	Bakersfield South	49	1,740	Institutional	64	62	66	2	None	201	886
4F-058	B2	Bakersfield South	78	1,272	Institutional	67	66	69	3	None	91	966
HP-034	B2	Bakersfield South	49	520	Institutional	66	67	70	4	Moderate	131	656
HP-035	B2	Bakersfield South	49	193	Institutional	66	71	72	6	Moderate	131	656
HP-036	B2	Bakersfield South	49	225	Residential	66	70	72	6	Severe	591	1,826
HP-037	B2	Bakersfield South	49	658	Residential	66	66	69	3	Moderate	591	1,826
HP-038	B2	Bakersfield South	49	613	Institutional	66	67	69	3	Moderate	131	656
HP-039	B2	Bakersfield South	49	515	Residential	64	67	69	5	Severe	791	2,476
HP-040	B2	Bakersfield South	49	881	Residential	64	65	67	4	Moderate	791	2,476
HP-041	B2	Bakersfield South	49	823	Residential	64	65	68	4	Moderate	791	2,476
HP-042	B2	Bakersfield South	49	722	Residential	63	66	68	5	Severe	916	2,891

Table 6-24
Operational Noise Levels and Contours – Bakersfield South Alternative

Site Name	Segment ID	Segment Name	Source Height (feet)	Source to Receiver Distance (feet)	Land Use Type	Existing Noise Level (Ldn)	Project Level Unmitigated (Ldn)	Total Level Unmitigated (Ldn)	Noise Level Increase (dBA)	FRA Impact - No Mitigation	Severe Impact Contour Distance (feet)	Moderate Impact Contour Distance (feet)
HP-043	B2	Bakersfield South	49	664	Residential	63	66	68	5	Severe	916	2,891
HP-044	B2	Bakersfield South	49	620	Institutional	63	67	68	6	Moderate	266	1,041
HP-045	B2	Bakersfield South	49	420	Institutional	65	68	70	5	Moderate	171	796
HP-046	B2	Bakersfield South	49	365	Institutional	66	69	71	5	Moderate	131	656
HP-047	B2	Bakersfield South	49	435	Institutional	65	68	70	5	Moderate	171	796
HP-048	B2	Bakersfield South	49	745	Institutional	63	66	68	5	Moderate	266	1,041
HP-049	B2	Bakersfield South	49	525	Institutional	65	67	69	5	Moderate	171	796
HP-070	B2	Bakersfield South	66	356	Institutional	64	69	70	6	Moderate	206	1,181

Table 6-25
Noise Impacts – BNSF Alternative Alignment Through Bakersfield

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,300	2,723	4	1	11	1	16
Moderate	2,700	6,310	15	0	22	4	2

Table 6-26
Noise Impacts – Bakersfield South Alternative

Level of Impact	Distance to Impact (feet)	Residential	Schools	Hospitals	Churches	Parks	Historic
Severe	1,300	2,723	4	1	11	1	16
Moderate	2,700	5,932	15	0	20	2	2

6.3 Vibration Impacts Due to Project Operations

The FRA General Vibration Assessment is used to establish screening distances for potential vibration-sensitive land uses. The data listed in Table 4-4 comes from the FRA *High-Speed Ground Transportation Noise and Vibration Impact Assessment* manual (FRA 2005), which lists the vibration screening distance at residential and institutional land uses at 275 feet and 220 feet, respectively. This is based on the assumption that the high-speed trains will reach speeds of up to 220 mph. Any residential and institutional land use beyond the screening distances would not be impacted by vibration levels generated by the HST project.

The FRA uses a vibration criterion of 72 VdB at residential land uses and 65 VdB at buildings where vibrations would interfere with interior operations. A 65 VdB criterion level is also used for buildings that are deemed "historical structures" or 4(f) sites. The distance to the 72 VdB and 65 VdB contours will need to be calculated in order to narrow down the potential impacts due to vibration levels generated by HST project operations at vibration-sensitive land uses.

The FRA Detailed Vibration Assessment is utilized in order to get an in-depth analysis for each alternative. In order to determine the actual transmission characteristics of vibration through the soils along the project right-of-way, Transfer Mobility testing must be conducted. Subsequently, transfer mobility tests were conducted as part of the detailed assessment. Transfer mobility test results were used in order to develop a better understanding of how vibrations from train operations would propagate through different soil types throughout the length of the project railway corridor.

Transfer mobility is a measure of the relationship between the exciting force and the response at each accelerometer position. The transfer mobility measurements were taken between December 14, 2010 and January 7, 2011. A total of 18 vibration propagation measurements were taken to estimate the vibration transfer mobility along the proposed California High Speed Rail Alignment between Fresno and Bakersfield. A description of the propagation test equipment and protocol is given below. The site specific details of the transfer mobility testing are presented in Appendix G.

Vibration testing was performed at 18 sites along the Fresno to Bakersfield CAHSR corridor. The measurement equipment consisted of:

- Transducers: PCB Model 393A03 Seismic Accelerometers (6)
- Data Recorders: Rion DA-20 4-channel digital data recorder (2)
- Accelerometer Calibrator: PCB Model 394C06 (1)
- Drop Hammer for transfer mobility tests (45 lb. weight dropped 4 ft.)
- Associated cables and field equipment

The accelerometers were mounted in the vertical direction. For paved surfaces, the accelerometers were attached to 4 inch square aluminum plates that were attached to the paved surface with a gel material (earthquake gel). Six inch steel stakes were used to attach the accelerometers to bare ground. The impact tests at each site were performed at 15 foot intervals along a 150 foot line.

The locations of the transfer mobility sites are listed in Table 6-27. During the measurements, vibration data is collected at nineteen 1/3 octave bands from 5 Hz up to 315 Hz from several accelerometers simultaneously. Once the field data is collected, then the data is processed by calculating the line source transfer mobility (LSTM) for each 1/3 octave band. The LSTM calculation consists of a line integration of the point source transfer mobilities at each accelerometer position. The LSTM values are then added to the force density values for the Pendolino system at each 1/3 octave band. The results produce the projected vibration level in VdB for the HST trainset at a given distance for each 1/3 octave band. The vibration levels at each measurement site corrected for velocity (220 mph), and plotted relative to distance from the source, are presented in Figure 6-1.

Table 6-27
Location of Transfer Mobility Measurement Sites

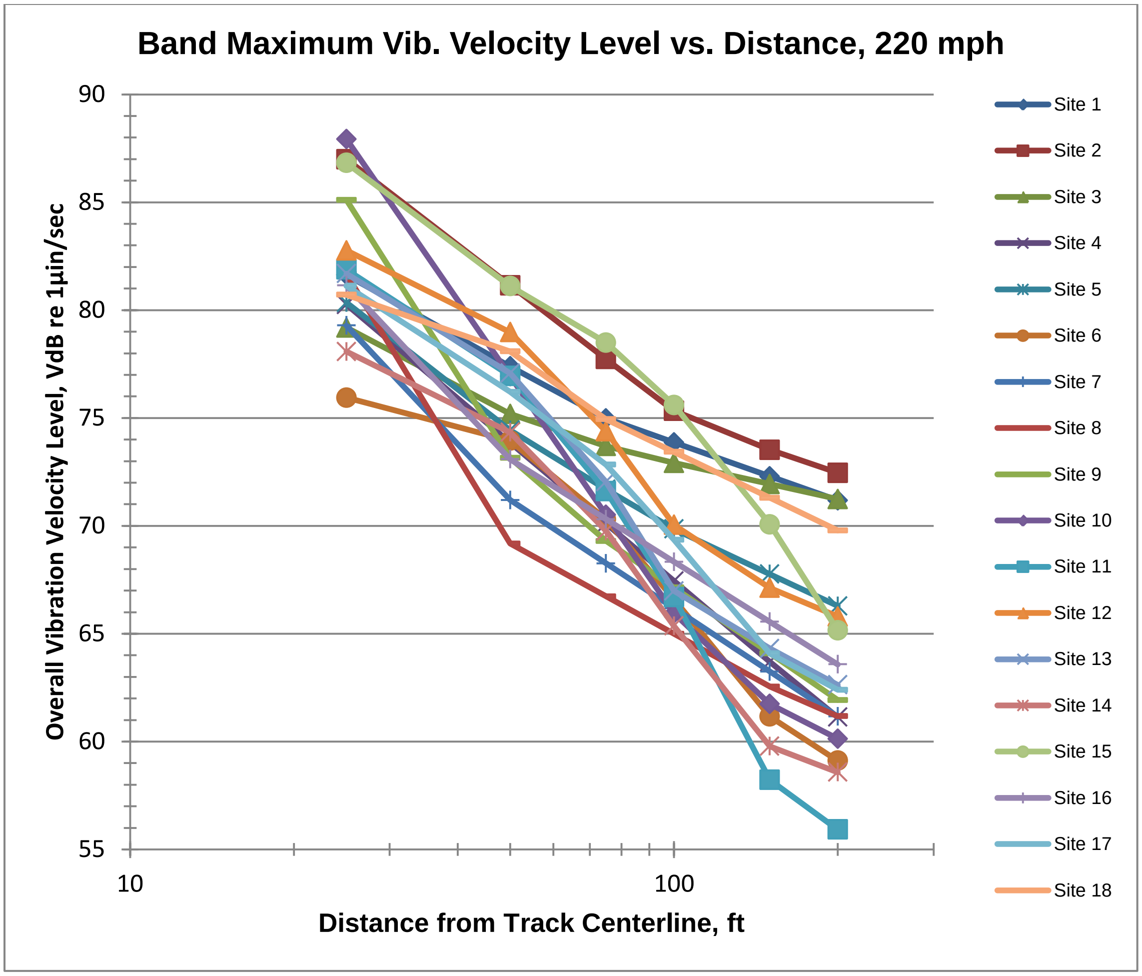
Site	Location
1	East American Avenue and South Cedar Avenue, Fresno
2	East Manning Avenue and South Chestnut Avenue, Fresno
3	East Nebraska Avenue and South Chestnut Avenue, Fresno
4	Elder Avenue and 9th Avenue, Hanford
5	Grangeville Boulevard and 7 1/2th Street, Hanford
6	Kansas Avenue and 7th Avenue, Hanford
7	Nevada Avenue and 6th Avenue, Corcoran
8	Avenue 170 and Road 24, Corcoran
9	Avenue 112 and Highway 43 (Northeast of canal), Corcoran
10	Avenue 88, Corcoran
11	Road 80 and Avenue 32, Earlimart
12	Garces Highway and Magnolia Avenue, Wasco
13	North Palm Avenue and Taussig Avenue, Wasco
14	Poso Avenue and Root Avenue, Wasco
15	McCrumb Lane and Venable Lane, Shafter
16	Lerdo Highway and Cherry Avenue, Shafter
17	Fenucchi Way and Zachary Avenue, Shafter
18	Brimhall Road and Harvest Creek Road, Bakersfield

The fall-off rate for vibration levels due to distance has been derived from the curves presented in Figure 6-1. The formula has been adjusted in order to take into account the 220 mph speed associated with this HST project. The formula for adjusting vibration levels with distance from the tracks is as follows:

$$L_v(d) = 20.4\log\left(\frac{25}{d}\right) + 82.98$$

where: $L_v(d)$ = RMS vibration velocity level at distance d

d = distance from the tracks



Source: ATS Consulting 2011

Figure 6-1
Ground-borne vibration vs. distance (from 1/3 octave band data)

Table 6-28 summarizes the distance to the 72 VdB and 65 VdB contours based on the formula extrapolated from the vibration-distance equation. The formula has been adjusted for a speed of 220 mph. All residential structures within a distance of 86 feet and all 4(f) site structures within a distance of 190 feet from the centerline of any proposed at-grade alignment have the potential to be impacted by vibration levels from the HST project. When the alignment is on the aerial structure, it has been included within Table 8-2 of the FRA assessment guidelines that the concrete aerial structure reduces the vibration level by approximately 10 VdB. Therefore, all residential structures located within 28 feet and all 4(f) structures located within 62 feet of the centerline of the proposed aerial structure would have the potential to be impacted by vibration levels from the HST project.

The vibration measurement data taken at locations adjacent to the existing BNSF alignment shows that these residences are currently exposed to rail vibration levels in excess of the vibration standard of 72 VdB. Tables 6-29, 6-30, 6-31, 6-32, 6-33, 6-34, and 6-35 list the vibration impacts for each proposed HST segment. Using the equation above developed from the transfer mobility testing, the projected vibration levels were calculated at these residential receivers currently exposed to vibration from freight operations. The results show that the homes located adjacent to an aerial structure would experience an average vibration level of 66 VdB, which is well below the vibration standard of 72 VdB. For the measurements conducted where the project alignment would be at-grade with the existing rail line, the modeled vibration levels would be at least 8 VdB below the existing vibration levels measured for freight operations. According to the vibration analysis, all of the residential land uses located within 86 feet of the alignment centerline and all 4(f) sites located within 62 feet of the alignment centerline would be exposed to vibration levels of 72 VdB or greater. It is expected that any residential dwelling located this close to the alignment would also be within the project right-of-way, and as such would be taken when the project is constructed. Therefore no vibration impacts on residential dwellings are expected.

Table 6-28
Distances to Vibration Criterion Level Contours

Land Use	Vibration Criterion Level (VdB)	Distance to Vibration Contour (feet)
Category 1 – At-grade	65	190
Category 2 – At-grade	72	86
Category 3 – At-grade	75	62
Category 1 – Aerial	65	62
Category 2 – Aerial	72	28
Category 3 – Aerial	75	20

6.3.1 Alternative Alignment Through Fresno

Table 6-29
Vibration Impacts – Alternative Alignment Fresno

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF - Fresno	1	0	0	0	0	0

6.3.2 Alternative Alignment Through Hanford East

Table 6-30
Vibration Impacts – Hanford

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF – Hanford -East	8	0	0	0	0	3

6.3.3 Alternative Alignment Through Corcoran

Table 6-31
Vibration Impacts – Corcoran

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
Through Corcoran	11	0	0	0	0	1
Corcoran Elevated	0	0	0	0	0	0
Corcoran Bypass	20	0	0	0	0	0

6.3.4 Alternative Alignment Through Pixley

Table 6-32
Vibration Impacts – Pixley

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF - Pixley	0	0	0	0	0	0

6.3.5 Alternative Alignment Through Allensworth

Table 6-33
Vibration Impacts – Allensworth

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF - Allensworth	1	0	0	0	0	1
Allensworth Bypass	1	0	0	0	0	0
*Sites 4F-6 through 4F-8 are the same historic site, but were modeled at different locations within the site. The site is only counted once at its closest distance						

6.3.6 Alternative Alignment Through Wasco-Shafter

Table 6-34
Vibration Impacts – Wasco-Shafter

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF – Wasco-Shafter	5	0	0	0	0	0
Wasco-Shafter Bypass	2	0	0	0	0	0

6.3.7 Alternative Alignment Through Bakersfield

Table 6-35
Vibration Impacts – Bakersfield

Project Alignment	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF - Bakersfield	14	0	0	0	0	0
Bakersfield South	9	0	0	0	0	0

There were a total of 77 sensitive receiver sites identified within the vibration impact screening distances listed in Table 6-28. The projected vibration level at each of these sites has been calculated and the results are presented in Table 6-36. This table includes the site name, the project alignment to which it is adjacent, the distance between the structure on the site and the alignment centerline, the distance between the structure on the site and the centerline of the nearest rail, the land use type, the modeled vibration level in VdB, the impact, and the recommended remedy. For all of the sites where mitigation is recommended, the specific mitigation measures listed in Table 7-8 should be applied as appropriate and necessary.

Table 6-36
Projected Vibration Levels and Impacts – All

Site Name	Segment	Centerline to Receiver Distance (feet)	Near Rail to Receiver Distance (feet)	Land Use Type	Estimated Vibration Level (VdB)	Vibration Impact	Remedy
HP-064-F4	BNSF - Fresno	39	31	Canal	81.1	No	None
HP-065-H2	BNSF - Hanford East	14	6	Canal	95.6	No	None
HE-018-H2	BNSF - Hanford East	16	8	Residential	92.6	Yes	Taken
HE-026-H2	BNSF - Hanford East	41	33	Residential	80.6	Yes	Taken
HP-068-H2	BNSF - Hanford East	50	42	Canal	68.4	No	None
LT-115-H2	BNSF - Hanford East	68	60	Residential	65.3	No	None
HE-003-H2	BNSF - Hanford East	72	64	Residential	74.6	Yes	Mitigation
LT-092-H2	BNSF - Hanford East	90	82	Residential	62.5	No	None
HE-015a-H2	BNSF - Hanford East	92	84	Residential	72.3	Yes	Mitigation
HE-001-H2	BNSF - Hanford East	93	85	Residential	72.2	Yes	Mitigation

Table 6-36
Projected Vibration Levels and Impacts – All

Site Name	Segment	Centerline to Receiver Distance (feet)	Near Rail to Receiver Distance (feet)	Land Use Type	Estimated Vibration Level (VdB)	Vibration Impact	Remedy
HE-005-H2	BNSF - Hanford East	97	89	Residential	71.7	No	None
HP-066-H2	BNSF - Hanford East	100	92	Canal	71.4	No	None
C3&4-Vib-1	BNSF - Corcoran	10	2	Residential	105.4	Yes	Taken
C3&4-Vib-2	BNSF - Corcoran	104	96	Residential	71.1	No	None
HP-054	BNSF - Corcoran	121	113	Cemetery	69.6	No	Mitigation
C3&4-Vib-3	BNSF - Corcoran	9	1	Residential	111.5	Yes	Taken
C3-Vib-1	BNSF - Corcoran	38	30	Residential	81.4	Yes	Taken
C3-Vib-2	BNSF - Corcoran	56	48	Residential	77.2	Yes	Taken
C3-Vib-3	BNSF - Corcoran	87	79	Residential	72.8	Yes	Mitigation
C3-Vib-4	BNSF - Corcoran	61	53	Residential	76.3	Yes	Mitigation
C3-Vib-5	BNSF - Corcoran	96	88	Residential	71.8	Yes	Mitigation
C3-Vib-6	BNSF - Corcoran	72	64	Residential	74.7	Yes	Mitigation
C3-Vib-7	BNSF - Corcoran	62	54	Residential	76.2	Yes	Mitigation
C3-Vib-8	BNSF - Corcoran	88	80	Residential	72.7	Yes	Mitigation
C4-Vib-1	Corcoran Bypass	15	7	Residential	94.3	Yes	Taken
C4-Vib-2	Corcoran Bypass	90	82	Residential	72.5	No	None
C4-Vib-3	Corcoran Bypass	9	1	Residential	111.5	Yes	Taken
C4-Vib-4	Corcoran Bypass	55	47	Residential	77.4	Yes	Mitigation
C4-Vib-5	Corcoran Bypass	48	40	Residential	78.8	Yes	Taken

Table 6-36
Projected Vibration Levels and Impacts – All

Site Name	Segment	Centerline to Receiver Distance (feet)	Near Rail to Receiver Distance (feet)	Land Use Type	Estimated Vibration Level (VdB)	Vibration Impact	Remedy
C4-Vib-6	Corcoran Bypass	9	1	Residential	111.5	Yes	Taken
C4-Vib-7	Corcoran Bypass	50	42	Residential	78.4	Yes	Taken
C4-Vib-8	Corcoran Bypass	88	80	Residential	72.7	Yes	None
C4-Vib-9	Corcoran Bypass	49	41	Residential	78.6	Yes	Taken
C4-Vib-10	Corcoran Bypass	9	1	Residential	111.5	Yes	Taken
C4-Vib-11	Corcoran Bypass	33	25	Residential	83.0	Yes	Taken
C4-Vib-12	Corcoran Bypass	9	1	Residential	111.5	Yes	Taken
C4-Vib-13	Corcoran Bypass	83	75	Residential	73.2	Yes	Mitigation
C4-Vib-14	Corcoran Bypass	73	65	Residential	74.5	Yes	Mitigation
C4-Vib-15	Corcoran Bypass	9	1	Residential	111.5	Yes	Taken
C4-Vib-16	Corcoran Bypass	89	81	Residential	72.6	No	None
ST-041-A2	BNSF - Allensworth	54	46	Residential	77.6	Yes	Taken
LT-030-A2	BNSF - Allensworth	232	224	Residential	63.6	No	None
ST-041-A1	Allensworth Bypass	29	21	Residential	84.6	Yes	Taken
LT-011-WS4	BNSF - Wasco-Shafter	14	6	Residential	95.2	Yes	Taken
LT-022-WS4	BNSF - Wasco-Shafter	20	12	Residential	79.7	Yes	Taken
ST-018-WS4	BNSF - Wasco-Shafter	36	28	Residential	82.1	Yes	Taken
ST-017-WS4	BNSF - Wasco-Shafter	44	36	Institutional	79.7	No	Taken
LT-012-WS4	BNSF - Wasco-Shafter	111	103	Residential	70.4	No	None

Table 6-36
Projected Vibration Levels and Impacts – All

Site Name	Segment	Centerline to Receiver Distance (feet)	Near Rail to Receiver Distance (feet)	Land Use Type	Estimated Vibration Level (VdB)	Vibration Impact	Remedy
4F-057-WS2	Wasco-Shafter Bypass	75	67	Park	74.2	No	None
ST-142-WS2	Wasco-Shafter Bypass	9	1	Residential	111.5	Yes	Taken
LT-007-B1	BNSF - Bakersfield	209	201	Residential	54.5	No	None
ST-001-B1	BNSF - Bakersfield	21	13	Institutional	79.0	Yes	Taken
HP-036-B1	BNSF - Bakersfield	25	17	Residential	76.4	Yes	Taken
HP-070-B1	BNSF - Bakersfield	47	39	Institutional	69.0	Yes	Taken
LT-006-B1	BNSF - Bakersfield	147	139	Residential	57.8	No	None
ST-160-B1	BNSF - Bakersfield	84	76	Residential	63.1	No	None
ST-008-B1	BNSF - Bakersfield	93	85	Residential	62.2	No	None
LT-005-B1	BNSF - Bakersfield	319	311	Residential	50.6	No	None
LT-159-B1	BNSF - Bakersfield	124	116	Residential	59.4	No	None
LT-004-B1	BNSF - Bakersfield	45	37	Residential	69.5	Yes	Taken
ST-009-B1	BNSF - Bakersfield	153	145	Residential	57.4	No	None
HP-034-B1	BNSF - Bakersfield	162	154	Institutional	56.9	No	None
4F-011-B1	BNSF - Bakersfield	164	156	Institutional	56.8	No	None
LT-003-B1	BNSF - Bakersfield	9	1	Residential	111.5	Yes	Taken
LT-007-B2	Bakersfield South	209	201	Residential	54.5	No	None
LT-004-B2	Bakersfield South	192	184	Residential	55.3	No	None
LT-006-B2	Bakersfield South	147	139	Residential	57.8	No	None

Table 6-36
Projected Vibration Levels and Impacts – All

Site Name	Segment	Centerline to Receiver Distance (feet)	Near Rail to Receiver Distance (feet)	Land Use Type	Estimated Vibration Level (VdB)	Vibration Impact	Remedy
LT-005-B2	Bakersfield South	281	273	Residential	51.8	No	None
LT-003-B2	Bakersfield South	186	178	Residential	55.6	No	None
ST-002-B2	Bakersfield South	118	110	Residential	59.9	No	None
ST-009-B2	Bakersfield South	163	155	Residential	56.8	No	None
ST-161-B2	Bakersfield South	167	159	Residential	56.6	No	None
ST-195a-B2	Bakersfield South	53	45	Residential	67.8	No	None

6.4 Heavy Maintenance Facility

According to the screening procedures for fixed noise sources found in the FTA's *Transit Noise and Vibration Impact Assessment* manual (FTA 2006), only noise-sensitive land uses within 1,000 feet of maintenance yards and shop facilities and within 125 feet of parking facilities need to be analyzed.

There are five proposed locations for the heavy maintenance facility that will be located along the HST project corridor that will run from Fresno to Bakersfield. A detailed assessment cannot be completed for each of the three proposed locations because the operations at the proposed maintenance facility have not been established. A general assessment can be completed using the screening distances found in the *Transit Noise and Vibration Impact Assessment* manual (FTA 2006). Table 6-37 shows the screening distances for parking areas and maintenance facilities. The screening distance for a maintenance facility is 1,000 feet and the screening distance for a parking area is 125 feet. The impact analysis will be limited to noise generated only by the maintenance facility because the parking facilities at each proposed location have not been established.

Table 6-37
FRA Screening Distances for Parking and Maintenance Facilities

Type of Facility	Screening Distance (feet)
Parking Facility	125
Maintenance Facility	1,000
Source: FTA 2006	

The facility will be expected to operate on a 24-hour a day schedule. According to the noise standards as listed within the California Noise and Land Use Compatibility Matrix, it is normally acceptable for industrial land uses to generate noise levels as high as 75 dBA at their property line. The nighttime noise ordinance limits for residential land uses for most of the communities along the right-of-way is 50 dBA. If the 75 dBA source level at the maintenance facility is measured at a distance of 50 feet from the source, then any noise-sensitive land use within 900 feet of the facility will be exposed to noise levels in excess of the nighttime noise standard. For this reason, a distance of 900 feet will be used for this screening analysis. Depending upon the site location, there would be existing homes located less than 100 feet from the proposed facility, which means they could be exposed to levels as high as 69 dBA. This is a potentially significant impact relative to the nighttime noise standard of 50 dBA.

The first proposed location for the heavy maintenance facility is on the southeast side of Fresno. The proposed location stretches from the intersection of South Cedar Avenue and South Parkway Drive on the northwest side of the facility to the intersection of South Maple Avenue and East Adams Avenue on the southeast side of the facility. Given the proposed location of the heavy maintenance facility, the number of homes within a radius of 900 feet is 100 single-family residences.

The second proposed location for the heavy maintenance facility is on the southeast side of Hanford. The proposed maintenance facility location stretches from the intersection of Houston Avenue and Central Valley Highway (Highway 43) on the northwest side of the facility to the intersection of 7th Avenue and Idaho Avenue on the southeast side of the facility. Given the proposed location of the heavy maintenance facility, the number of homes within a radius of 900 feet is 6 single-family residences.

The third proposed maintenance facility location is on the east side of Wasco. The site is bordered by Highway 46 to the north, J Street to the west, and Filburn Avenue to the south. The east boundary of the facility would be about one-half mile west of Root Avenue. Given the proposed location of this heavy maintenance facility site, the number of homes within a radius of 900 feet is 327 dwelling units, which are made up of a combination of single-family residences and multi-family apartment buildings.

The fourth proposed location for the heavy maintenance facility is in between Shafter and Bakersfield. The proposed maintenance facility location stretches from the intersection of Burbank Street and Mendota Street on the northwest side of the facility to the intersection of 7th Standard Road and Zachary Avenue on the southeast side of the facility. Given the proposed location of the heavy maintenance facility, the number of homes within a radius of 900 feet is 6 single-family residences.

The fifth proposed location for the heavy maintenance facility is in between Shafter and Bakersfield. The proposed maintenance facility location stretches from the intersection of Burbank Street and South Central Valley Highway on the northwest side of the facility to the intersection of Roxy Lane and Santa Fe Way on the south side of the facility. Given the proposed location of the heavy maintenance facility, the number of homes within a radius of 900 feet is 8 single-family residences.

Table 6-38 summarizes the number of homes within the recommended screening distance for the maintenance facility. Based on the screening distances provided by the FTA Noise and Vibration Manual, the third proposed location for the heavy maintenance near Wasco has the potential to generate the most noise impacts at nearby noise-sensitive receivers. The heavy maintenance facility near Fresno has the potential to generate the second-most noise impacts at nearby noise-sensitive receivers. The proposed heavy maintenance facility near Hanford or Shafter will potentially generate the least amount of noise impacts at nearby noise-sensitive receivers.

Table 6-38
Number of Noise-Sensitive Receivers within Screening Distances for the Heavy Maintenance Facility

Facility Location	Screening Distance (feet)	Number of Dwellings within Screening Distance
Fresno	900	100
Hanford	900	6
Wasco	900	327
Shafter/East	900	6
Shafter/West	900	8

6.5 Traction Power Substation

According to the screening procedures for fixed noise sources found in the FTA manual (May 2006), the screening distance for power substations is 250 feet. This is the distance at which the noise level of the facility, as measured from the center of the source, would be 50 dBA. Only three of the proposed substation locations would be located within 250 feet of a noise-sensitive land use. The substation proposed to be located at Orange Street and Oleander Street would be located 203 feet from the nearest house to the west. At this distance, the noise level would be 51.8 dBA. The two possible substations proposed to be located on Elzworth Street, north of Brimhall Road, would be located either 93 feet or 99 feet from the nearest residential property line. At these distanced, the noise level would be 58.6 dBA and 58.0 dBA, respectively.

These noise levels would exceed the nighttime noise standard of 50 dBA, therefore there would be impacts on the adjacent residential land uses, and noise mitigation measures would be required.

6.6 Project Operational Traffic Noise

The implementation of the HST project will cause increased traffic volumes in the areas around the station locations. The three major areas where traffic volumes would be increased would be around the City of Fresno, east of the City of Hanford, and in the City of Bakersfield. Traffic around the City of Corcoran would also increase due to the possibility of the track going through the city at-grade. Existing and Existing Plus Project traffic conditions as well as Future (year 2035) and Future Plus Project traffic conditions are compared in order to analyze the change in noise levels due to the increase in ADT and peak hour traffic volumes in these four cities. Estimated traffic volumes for the year 2035 were obtained from the project traffic study and are used in this analysis. It is assumed that the same standard arterial vehicle mix is used for all ADT and peak hour traffic volumes. The following formula is used to estimate the change in CNEL values along roadway segments with and without the completion of the HST project:

$$(\Delta) = 10\log\left(\frac{a}{b}\right)$$

where: *(Δ)* = change in noise level (dBA) due to implementation of HST project

a = ADT/peak hour traffic volume with HST project

b = ADT/peak hour traffic volume without HST project

6.6.1 Traffic Noise in the City of Fresno

Table 6-39 lists the major roadway segments and intersections in the city of Fresno that are being analyzed as part of the traffic study. The ADT volumes for each roadway segment are listed in Table 6-39 for the year 2035 with and without the completion of the HST project. The change in CNEL value for each roadway segment is then calculated.

Table 6-39
City of Fresno Year 2035 Traffic – Change in Traffic Noise Levels Due to Project

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
Fulton Street, between CA 180 EB Ramps and E. Divisadero Street	8,230	8,380	0
Van Ness Avenue, between CA 180 EB Ramps and E. Divisadero Street	13,670	14,450	0
E. Divisadero Street, between H Street and Broadway Street	32,610	32,610	0
H Street, between E. Divisadero Street and Stanislaus Street	16,150	16,410	0
Broadway Street, between San Joaquin Street and Stanislaus Street	12,730	12,730	0
Van Ness Avenue, between Stanislaus Street and E Divisadero Street	8,280	9,220	0
Stanislaus Street, between Van Ness Avenue, and O Street	17,440	17,780	0
N. Blackstone Avenue, between McKenzie Avenue and E. Belmont Avenue	21,360	21,700	0
N. Abby Street, between McKenzie Avenue and E. Belmont Avenue	16,980	17,340	0
E. Belmont Avenue, between N. Fresno Street and N. Abby Street	34,810	34,810	0
Stanislaus Street, between Broadway Street, and E Street	24,100	24,120	0
Tuolumne Street, between Broadway Street, and E. Street	13,060	13,070	0
Tuolumne Street, between Van Ness Avenue and O Street	8,530	8,530	0
Fresno Street, between P Street and M Street	29,000	29,810	0
Fresno Street, between M Street and Van Ness Avenue	22,500	23,330	0
Fresno Street, between Van Ness Avenue and Broadway Street	25,700	26,840	0
Fresno Street, between G Street and SR 99 NB Ramps	27,890	29,920	0
Fresno Street, between C Street and B Street	34,380	34,510	0
Van Ness Avenue, between Fresno Street and Tulare Street	14,970	15,960	0
Tulare Street, between Broadway Street and Van Ness Avenue	30,210	31,640	0
Tulare Street, between R Street and U Street	22,310	23,110	0
Divisadero Street, between N. Fresno Street and SR 41 Ramps	27,160	29,860	0
Tulare Street, between SR 41 Ramps and N 1st Street	34,630	34,790	0
M Street, between Tulare Street and Inyo Street	17,230	17,280	0

Table 6-39
City of Fresno Year 2035 Traffic – Change in Traffic Noise Levels Due to Project

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
Inyo Street, between Broadway Street and Van Ness Avenue	9,790	11,140	1
Van Ness Avenue, between Inyo Street and Ventura Avenue	13,120	14,040	0
P Street, between Inyo Street and Ventura Avenue	8,800	8,820	0
Ventura Avenue, between B Street and C Street	30,390	30,520	0
Ventura Avenue, between E Street and G Street	24,450	24,580	0
Broadway Street, between Ventura Avenue and SR 41 Ramps	19,480	19,480	0
Van Ness Ave, between Ventura Ave and SR 41 Ramps	19,420	20,240	0
Ventura Avenue, between M Street and Van Ness Avenue	21,310	21,410	0
Ventura Ave, between P Street and N. First Street	35,260	35,390	0
N. Blackstone Avenue, between SR 180 EB Ramps and E. Belmont Avenue	26,250	26,590	0
N. Abby Street, between SR 180 EB Ramps and E. Belmont Avenue	23,480	23,840	0
On NW Avenue, North of W. McKinley Avenue	22,618	22,658	0
On N. Weber Avenue, North of W. McKinley Avenue	9,770	9,772	0
On W. McKinley Avenue, East of NW Avenue	15,336	15,344	0
On NW Avenue, South of W. McKinley Avenue	17,530	17,580	0
On N. Weber Avenue, North of W. Olive Avenue	20,344	20,404	0
On W. Olive Avenue, West of N. Weber Avenue	36,662	36,672	0
On W. Olive Avenue, East of N. Weber Avenue	27,004	27,018	0
On N. Weber Avenue, South of W. Olive Avenue	16,320	25,090	2
On N. Motel Drive, North of W. Belmont Avenue	10,840	n/a*	n/a
On N. Weber Avenue, North of W. Belmont Avenue	14,860	23,630	2
On W. Belmont Avenue, West of N. Motel Drive	21,822	21,836	0
On E. Belmont Avenue, East of N. Weber Avenue	27,826	27,846	0
On N. H Street, South of E. Belmont Avenue	9,758	9,888	0
*roadway segment closing if project is constructed			

6.6.2 Traffic Noise around Kings-Tulare Regional Station

Table 6-40 lists the major roadway segments in the area around the proposed Kings-Tulare Regional Station that are being analyzed as part of the traffic study. The ADT volumes for each roadway segment are listed in the table for the year 2035 with and without the completion of the HST project. The change in CNEL value for each roadway segment is then calculated.

Table 6-40
Kings-Tulare Regional Station Year 2035 Traffic—Change in Traffic Noise Levels

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
SR 43 between Grangeville Blvd. and SR 198	12,850	14,960	1
SR 43 between SR 198 and Hanford-Armona Road	14,080	14,340	0
SR 198 between 11th Ave. and 10th Ave.	46,672	46,672	0
SR 198 between 10th Ave. and 9th Ave.	28,700	29,630	0
SR 198 between 9th Ave. and 8th Ave.	23,150	24,110	0
SR 198 between 8th Ave. and 7th Ave.	21,860	22,250	0
SR 198 between 7th Ave. and 6th Ave.	21,180	21,990	0
SR 198 between 6th Ave. and 2nd Ave.	19,320	20,080	0
SR 198 between 2nd Ave. and Road 48	20,240	20,940	0
SR 198 between Road 48 and Road 56	30,126	30,126	0
SR 198 between Road 56 and Road 60	30,126	30,126	0
SR 198 between Road 60 and Road 68	30,126	30,126	0
SR 198 between Road 68 and SR 99	30,126	30,126	0

6.6.3 Traffic Noise in the City of Bakersfield

Table 6-41 lists the major roadway segments in the City of Bakersfield that are being analyzed as part of the traffic study. The ADT volumes for each roadway segment are listed in the table for the year 2035 with and without the completion of the HST project. The change in CNEL value for each roadway segment is then calculated.

Table 6-41
City of Bakersfield Year 2035 Traffic—Change in Traffic Noise Levels

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
24th Street between SR 99 Ramps and Oak Street	66,350	66,510	0
24th Street between 23rd Street and F Street	39,260	39,260	0
23rd Street between 24th Street and F Street	36,800	36,800	0
23rd Street between F Street and M Street	36,780	36,780	0
Niles Street between Beale Avenue and Williams Street	7,760	7,760	0
Monterey Street between Beale Avenue and Williams Street	8,050	8,050	0
Truxtun Avenue between SR 99 and Oak Street	51,290	51,560	0
Truxtun Avenue between Oak Street and F Street	35,570	36,000	0

Table 6-41
City of Bakersfield Year 2035 Traffic—Change in Traffic Noise Levels

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
Truxtun Avenue between F Street and H Street	35,560	35,990	0
Truxtun Avenue between N Street and Q Street	28,800	29,130	0
Truxtun Avenue between Q Street and Union Avenue	22,560	22,750	0
California Avenue between SR 99 and Oak Street	41,930	43,970	0
California Avenue between Oak Street and A Street	21,460	23,670	0
California Avenue between Oleander Ave. and H Street	25,750	27,990	0
California Avenue between N Street and P Street	19,830	22,280	1
California Avenue between P Street and Union Avenue	22,240	24,790	0
California Avenue between Union Avenue and King Street	22,240	22,610	0
California Avenue between King Street and Owens Street	15,050	15,420	0
California Avenue between Owens Street and MLK Jr. Blvd.	12,210	12,580	0
California Avenue between MLK Jr. Blvd. and Mt. Vernon Avenue	12,210	12,580	0
Brundage Lane between Oak Street and A Street	13,390	13,420	0
Oak Street between 24th Street and Truxtun Avenue	36,330	36,490	0
F Street between SR 204 and 30th Street	17,820	17,880	0
F Street between 30th Street and 24th Street	15,280	15,340	0
F Street between 24th Street and 23rd Street	16,120	16,180	0
F Street between 23rd Street and 21st Street	10,020	10,080	0
F Street between 21st Street and 19th Street	8,790	8,790	0
Chester Avenue between 34th Street and 30th Street	25,180	25,320	0
Chester Avenue between 30th Street and 24th Street	18,660	18,670	0
Chester Avenue between 23rd Street and Truxtun Avenue	19,780	19,790	0
Chester Avenue between Truxtun Avenue and California Avenue	18,690	18,760	0
Chester Avenue between California Avenue and 4th Street	16,850	16,850	0
Chester Avenue between 4th Street and Brundage Lane	19,450	19,500	0
Q Street between 23rd Street and 21st Street	17,650	17,650	0
Q Street between 19th Street and Truxtun Avenue	16,440	16,440	0
Q Street between 14th Street and California Avenue	12,990	12,990	0
Q Street between California Avenue and 8th Street	12,250	12,350	0
Union Avenue between Espee Street and 21st Street	41,480	42,070	0
Union Avenue between 19th Street and Truxtun Avenue	52,360	53,620	0

Table 6-41
City of Bakersfield Year 2035 Traffic—Change in Traffic Noise Levels

Roadway Segment	2035 No Project ADT	2035 Plus Project ADT	Change in CNEL (dBA)
Union Avenue between Hayden Court to California Avenue	46,810	47,420	0
Union Avenue between California Avenue and 4th Street	45,530	47,500	0
Union Avenue between 4th Street and Brundage Lane	42,330	44,300	0
Beale Avenue between Flower Street and Niles Street	14,660	15,120	0
Beale Avenue between Monterey Street and 19th Street	16,940	17,400	0
Beale Avenue between Truxtun Avenue and California Avenue	36,330	36,500	0
Truxtun Avenue, between F Street and Chester Avenue	35,560	36,030	0

6.6.4 Peak Hour Traffic Noise in the City of Fresno

Table 6-42 lists a set of intersections in the vicinity of the proposed station in the City of Fresno which show the changes of peak hour traffic volume for both Existing and Existing Plus Project traffic conditions. AM and PM peak hour traffic volumes and the change in hourly L_{eq} noise levels for each leg of every respective intersection are analyzed. The results show that most of the roadways will have no increase in noise due to the project. In one case (Van Ness Ave.) the peak hour traffic noise will increase by 5 dB.

Table 6-42
City of Fresno Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
Ventura Avenue/SR 99 SB Ramps	North	349	349	PM	0
	South	149	149	PM	0
	East	1,193	1,206	PM	0
	West	1,345	1,353	PM	0
Ventura Avenue/SR 99 NB Ramps	North	685	685	PM	0
	South	94	94	PM	0
	East	1,369	1,382	PM	0
	West	1,152	1,160	PM	0
Ventura/E Street (off ramp from Golden State)	North	210	210	PM	0
	South	45	45	PM	0
	East	1,301	1,314	PM	0
	West	1,012	1,020	PM	0

Table 6-42
City of Fresno Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
Van Ness Avenue/Ventura Street	North	630	722	PM	1
	South	709	791	PM	0
	East	1,157	1,167	PM	0
	West	1,077	1,077	PM	0
Van Ness Ave./Inyo Street	North	628	671	PM	0
	South	611	703	PM	1
	East	187	187	PM	0
	West	235	370	PM	2
G Street/ Kern Street	North	323	321	PM	0
	South	321	322	PM	0
	East	74	n/a*	PM	n/a
	West	113	77	PM	-2
Tulare Street/E Street	North	215	218	PM	0
	South	194	194	PM	0
	East	294	294	PM	0
	West	194	197	PM	0
Tulare Street/F Street	North	147	147	PM	0
	South	137	137	PM	0
	East	297	297	PM	0
	West	180	180	PM	0
Tulare Street/G Street	North	305	375	PM	1
	South	321	334	PM	0
	East	376	459	PM	1
	West	219	219	PM	0
Van Ness Avenue/Tulare Street	North	859	958	PM	0
	South	685	728	PM	0
	East	711	810	AM	1
	West	548	717	PM	1
Tulare Street/SR 41 NB Ramps	North	0	0	PM	n/a
	South	1,089	1,134	PM	0
	East	986	994	PM	0
	West	1,546	1,603	PM	0
Fresno Street/G Street	North	335	335	PM	0
	South	300	370	PM	1
	East	1,177	1,207	PM	0
	West	833	963	PM	1

Table 6-42
City of Fresno Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
H Street/San Joaquin Street	North	476	502	PM	0
	South	477	503	PM	0
	East	11	11	PM	0
	West	0	0	PM	n/a
H Street/Amador Street.	North	499	499	PM	0
	South	513	513	PM	0
	East	42	55	AM	1
	West	0	0	PM	n/a
Broadway/Amador St	North	179	192	PM	0
	South	170	170	PM	0
	East	42	42	PM	0
	West	59	72	PM	1
Broadway/San Joaquin St.	North	174	174	PM	0
	South	178	178	PM	0
	East	63	63	PM	0
	West	52	52	PM	0
Van Ness Ave / E. Hamilton Ave	North	379	379	PM	0
	South	306	306	PM	0
	East	129	129	PM	0
	West	32	32	PM	0
S. Van Ness Ave / E. California Ave	North	318	493	PM	2
	South	305	305	PM	0
	East	60	183	PM	5
	West	31	83	PM	4
Golden State Blvd / E. Church Ave	North	900	968	PM	0
	South	532	631	PM	1
	East	894	1,061	PM	1
	West	602	602	PM	0
S. East Ave / E. Church Ave	North	244	332	PM	1
	South	0	0	PM	n/a
	East	765	839	PM	0
	West	935	1,097	PM	1
S. Sunland Ave / E. Church Ave	North	0	4	AM	n/a
	South	43	43	PM	0
	East	727	740	PM	0
	West	764	781	PM	0

Table 6-42
City of Fresno Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
S. East Ave / Golden State Blvd	North	113	113	PM	0
	South	173	173	PM	0
	East	512	611	PM	1
	West	568	667	PM	1
S. Orange Ave / Golden State Blvd	North	117	n/a*	PM	n/a
	South	248	234	PM	0
	East	353	425	PM	1
	West	538	561	PM	0
*Roadway segment closing if project is constructed					

Table 6-43 lists a set of intersections in the vicinity of the proposed station in the City of Fresno which show the changes of peak hour traffic volume for both Future No Build and Future Plus Project traffic conditions. AM and PM peak hour traffic volumes and the change in hourly L_{eq} noise levels for each leg of every respective intersection are analyzed. The results show that most of the roadways will have no increase in noise due to the project. In one case (Van Ness Ave.) the peak hour traffic noise will increase by 2 dB.

Table 6-43
City of Fresno Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Ventura Avenue/SR 99 SB Ramps	North	633	633	AM	0
	South	449	449	AM	0
	East	2081	2094	AM	0
	West	2079	2092	AM	0
Ventura Avenue/SR 99 NB Ramps	North	624	624	AM	0
	South	565	565	AM	0
	East	2234	2247	AM	0
	West	2095	2108	AM	0
Ventura/E Street (off ramp from Golden State)	North	302	302	AM	0
	South	89	89	AM	0
	East	2022	2035	AM	0
	West	2237	2250	AM	0

Table 6-43
City of Fresno Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Van Ness Avenue/Ventura Street	North	909	1001	AM	0
	South	1452	1534	AM	0
	East	1768	1778	AM	0
	West	1779	1779	AM	0
Van Ness Ave./Inyo Street	North	844	887	AM	0
	South	962	1054	AM	0
	East	404	404	AM	0
	West	680	815	AM	1
G Street/ Kern Street	North	286	267	AM	0
	South	949	919	PM	0
	East	200	n/a*	AM	n/a
	West	981	483	PM	-3
Tulare Street/E Street	North	793	796	AM	0
	South	277	277	AM	0
	East	896	896	AM	0
	West	754	757	AM	0
Tulare Street/F Street	North	152	152	AM	0
	South	367	367	AM	0
	East	970	970	AM	0
	West	867	867	AM	0
Tulare Street/G Street	North	488	518	AM	0
	South	295	308	AM	0
	East	1237	1280	AM	0
	West	1072	1072	AM	0
Van Ness Avenue/Tulare Street	North	1031	1118	AM	0
	South	998	1041	AM	0
	East	1094	1193	AM	0
	West	1237	1380	AM	0
Tulare Street/SR 41 NB Ramps	North	0	0	AM	n/a
	South	914	933	AM	0
	East	1011	1019	AM	0
	West	979	1006	AM	0
Fresno Street/G Street	North	665	665	AM	0
	South	424	454	AM	0
	East	1713	1783	AM	0
	West	1678	1778	AM	0

Table 6-43
City of Fresno Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
H Street/San Joaquin Street	North	1062	1089	AM	0
	South	1068	1095	AM	0
	East	32	32	AM	0
	West	0	0	AM	n/a
H Street/Amador Street.	North	1110	1124	AM	0
	South	1064	1091	AM	0
	East	166	179	AM	0
	West	0	0	AM	n/a
Broadway/Amador St	North	639	652	AM	0
	South	746	746	AM	0
	East	120	120	AM	0
	West	165	178	AM	0
Broadway/San Joaquin St.	North	744	744	AM	0
	South	799	799	AM	0
	East	262	262	AM	0
	West	227	227	AM	0
Van Ness Ave / E. Hamilton Ave	North	760	760	PM	0
	South	700	700	PM	0
	East	205	205	PM	0
	West	49	49	PM	0
S. Van Ness Ave / E. California Ave	North	696	1,076	PM	2
	South	790	790	PM	0
	East	1,415	1,720	PM	1
	West	1,387	1,462	PM	0
Golden State Blvd / E. Church Ave	North	4,019	4,144	PM	0
	South	3,762	4,344	PM	1
	East	2,881	3,588	PM	1
	West	2,660	2,660	PM	0
S. East Ave / E. Church Ave	North	1,076	1,201	PM	0
	South	0	0	PM	n/a
	East	2,243	2,759	PM	1
	West	3,245	3,886	PM	1
S. Sunland Ave / E. Church Ave	North	18	18	AM	0
	South	122	122	PM	0
	East	1,097	1,192	PM	0
	West	1,055	1,150	PM	0

Table 6-43
City of Fresno Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
S. East Ave / Golden State Blvd	North	153	153	PM	0
	South	213	213	PM	0
	East	3,750	4,332	PM	1
	West	3,730	4,312	PM	1
S. Orange Ave / Golden State Blvd	North	378	n/a*	PM	n/a
	South	419	403	PM	0
	East	3,208	3,709	PM	1
	West	3,497	3,798	PM	0
*Roadway segment closing if project is constructed					

6.6.5 Peak Hour Traffic Noise in the City of Corcoran

Traffic in the City of Corcoran will change if the BNSF Alternative Alignment through Corcoran is chosen from all of three possible alternatives. Traffic would be affected by this alignment because the BNSF Alternative Alignment through Corcoran would go through the City of Corcoran at-grade. Table 6-44 lists the Existing and Existing Plus Project traffic conditions during either the AM or PM peak hour and Table 6-45 lists the Future and Future Plus Project traffic conditions during either the AM or PM peak hour. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one case (Whitley Ave.) the peak hour traffic noise will increase by 3 dB and 7 dB for the Existing Plus Project case and the Future Plus Project Case, respectively.

Table 6-44
City of Corcoran Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
Brokaw Avenue and Chittenden Avenue	North	85	124	AM	2
	South	98	98	AM	0
	East	59	n/a*	AM	n/a
	West	68	48	AM	-2

Table 6-44
City of Corcoran Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM / PM	
Whitley Avenue and Chittenden Avenue	North	102	106	AM	0
	South	64	87	AM	1
	East	209	334	AM	2
	West	245	343	AM	1
Whitley Avenue and Pickerell Avenue	North	75	146	AM	3
	South	64	66	AM	0
	East	144	217	AM	2
	West	171	305	AM	3
Sherman Avenue and Santa Fe Avenue	North	83	16	AM	-7
	South	83	n/a*	AM	n/a
	East	21	16	AM	-1
	West	115	n/a*	AM	n/a
*Roadway segment closing if project is constructed					

Table 6-45
City of Corcoran Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Brokaw Avenue and Chittenden Avenue	North	85	361	AM	6
	South	98	335	AM	5
	East	79	n/a*	AM	n/a
	West	98	57	PM	-2
Whitley Avenue and Chittenden Avenue	North	102	106	AM	0
	South	64	87	AM	1
	East	209	577	AM	4
	West	245	586	AM	4
Whitley Avenue and Pickerell Avenue	North	380	605	PM	2
	South	337	413	PM	1
	East	205	1041	PM	7
	West	171	667	AM	6

Table 6-45
City of Corcoran Year 2035 Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Sherman Avenue and Santa Fe Avenue	North	320	16	AM	-13
	South	543	n/a*	AM	n/a
	East	21	16	AM	-1
	West	338	n/a*	AM	n/a
*Roadway segment closing if HST project is constructed					

6.6.6 Peak Hour Traffic Noise in the City of Bakersfield

Table 6-46 and Table 6-47 list another set of intersections and roadway segments in the city of Bakersfield for both Existing and Existing Plus Project traffic conditions. AM and PM peak hour traffic volumes and the change in hourly L_{eq} noise levels for each leg of every respective intersection are analyzed. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In several cases along California Avenue, the peak hour traffic noise will increase by 1 dB.

Table 6-46
City of Bakersfield Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
S Union Ave. and 4th Street	North	2,770	2,967	AM	0
	South	2,731	2,928	AM	0
	East	257	257	AM	0
	West	400	400	AM	0
P Street and 8th Street	North	397	408	AM	0
	South	385	394	AM	0
	East	128	128	AM	0
	West	115	116	AM	0
California Ave. and Oak St	North	2,615	2,615	AM	0
	South	1,163	1,174	AM	0
	East	1,830	2,051	AM	0
	West	2,881	3,091	AM	0

Table 6-46
City of Bakersfield Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
California Ave. and A Street	North	874	874	AM	0
	South	355	355	AM	0
	East	1,538	1,758	AM	1
	West	1,878	2,098	AM	0
California Ave. and Oleander Ave	North	n/a	n/a	AM	n/a
	South	222	222	AM	0
	East	1,661	1,881	AM	1
	West	1,567	1,787	AM	1
H St. and California Ave	North	1,044	1,045	AM	0
	South	996	996	AM	0
	East	1,578	1,802	AM	1
	West	1,675	1,895	AM	1
California Ave. and Chester Ave	North	1,523	1,525	AM	0
	South	1,020	1,020	AM	0
	East	1,316	1,547	AM	1
	West	1,525	1,749	AM	1
California Ave. and N Street.	North	103	103	AM	0
	South	35	35	AM	0
	East	1,129	1,374	AM	1
	West	1,152	1,397	AM	1
California Ave. and P Street	North	685	685	AM	0
	South	367	377	AM	0
	East	978	1,233	AM	1
	West	1,130	1,375	AM	1
California Ave. and Union Ave	North	2,523	2,616	AM	0
	South	2,270	2,467	AM	0
	East	1,143	1,181	AM	0
	West	1,095	1,234	AM	1
California Ave. and King St	North	158	158	AM	0
	South	329	329	AM	0
	East	931	968	AM	0
	West	974	1,011	AM	0
Truxtun Ave. and Oak Street	North	3,517	3,522	AM	0
	South	1,976	1,976	AM	0
	East	2,101	2,144	AM	0
	West	3,447	3,474	AM	0

Table 6-46
City of Bakersfield Existing Traffic—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
Truxtun Ave. and F Street	North	413	413	AM	0
	South	146	146	AM	0
	East	1,791	1,834	AM	0
	West	1,832	1,875	AM	0
Truxtun Ave. and H Street	North	850	850	AM	0
	South	991	995	AM	0
	East	1,666	1,705	AM	0
	West	1,795	1,838	AM	0
Truxtun Ave. and Chester Ave	North	1,203	1,203	AM	0
	South	1,327	1,334	AM	0
	East	1,748	1,780	AM	0
	West	1,611	1,649	AM	0
Truxtun Ave. and L Street	North	703	703	AM	0
	South	919	933	AM	0
	East	1,171	1,190	AM	0
	West	1,660	1,693	AM	0
Truxtun Ave. and N Street	North	325	325	AM	0
	South	239	239	AM	0
	East	1,080	1,099	AM	0
	West	1,186	1,205	AM	0
Truxtun Ave. and Q Street	North	575	575	AM	0
	South	654	654	AM	0
	East	1,038	1,057	AM	0
	West	1,109	1,128	AM	0
Q St. and 19th St	North	446	446	AM	0
	South	442	442	AM	0
	East	119	119	AM	0
	West	99	99	AM	0

Table 6-47
City of Bakersfield Year 2035—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
S Union Ave. and 4th Street	North	3,506	3,703	AM	0
	South	3,491	3,688	AM	0
	East	378	378	AM	0
	West	419	419	AM	0
P Street and 8th Street	North	742	753	AM	0
	South	626	635	AM	0
	East	179	179	AM	0
	West	158	159	AM	0
California Ave. and Oak St	North	2,615	2,615	AM	0
	South	1,163	1,174	AM	0
	East	1,830	2,051	AM	0
	West	2,881	3,091	AM	0
California Ave. and A Street	North	1,000	1,000	AM	0
	South	358	358	AM	0
	East	1,645	1,865	AM	1
	West	1,911	2,131	AM	0
California Ave. and Oleander Ave	North	n/a	n/a	AM	n/a
	South	234	234	AM	0
	East	1,673	1,893	AM	1
	West	1,567	1,787	AM	1
H St. and California Ave	North	1,073	1,074	AM	0
	South	1,129	1,129	AM	0
	East	1,740	1,964	AM	1
	West	1,675	1,895	AM	1
California Ave. and Chester Ave	North	1,690	1,692	AM	0
	South	1,156	1,156	AM	0
	East	1,316	1,547	AM	1
	West	1,602	1,826	AM	1
California Ave. and N Street.	North	113	113	AM	0
	South	36	36	AM	0
	East	1,135	1,380	AM	1
	West	1,155	1,400	AM	1

Table 6-47
City of Bakersfield Year 2035—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
California Ave. and P Street	North	991	991	AM	0
	South	778	788	AM	0
	East	1,298	1,553	AM	1
	West	1,143	1,388	AM	1
California Ave. and Union Ave	North	3,829	3,922	AM	0
	South	3,696	3,893	AM	0
	East	1,424	1,462	AM	0
	West	1,239	1,378	AM	0
California Ave. and King St	North	188	188	AM	0
	South	350	350	AM	0
	East	1,089	1,126	AM	0
	West	1,120	1,157	AM	0
Truxtun Ave. and Oak Street	North	4,040	4,045	AM	0
	South	1,976	1,976	AM	0
	East	2,251	2,294	AM	0
	West	3,842	3,869	AM	0
Truxtun Ave. and F Street	North	413	413	AM	0
	South	148	148	AM	0
	East	2,108	2,151	AM	0
	West	2,147	2,190	AM	0
Truxtun Ave. and H Street	North	928	928	AM	0
	South	1,053	1,057	AM	0
	East	1,956	1,995	AM	0
	West	2,100	2,143	AM	0
Truxtun Ave. and Chester Ave	North	1,306	1,306	AM	0
	South	1,454	1,461	AM	0
	East	1,983	2,015	AM	0
	West	1,790	1,828	AM	0
Truxtun Ave. and L Street	North	873	873	AM	0
	South	1,298	1,312	AM	0
	East	1,531	1,550	AM	0
	West	1,797	1,830	AM	0

Table 6-47
City of Bakersfield Year 2035—Change in Noise Levels Due to Change in Peak Hour Traffic Volumes

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Truxtun Ave. and N Street	North	399	399	AM	0
	South	336	336	AM	0
	East	1,485	1,504	AM	0
	West	1,522	1,541	AM	0
Truxtun Ave. and Q Street	North	768	768	AM	0
	South	1,047	1,047	AM	0
	East	1,680	1,699	AM	0
	West	1,455	1,474	AM	0
Q St. and 19th St	North	681	681	AM	0
	South	704	704	AM	0
	East	192	192	AM	0
	West	158	158	AM	0

6.6.7 Traffic Noise Due to Heavy Maintenance Facility

There are four proposed locations for the heavy maintenance facility that will be located along the high-speed train project alignment. The AM and PM peak hour traffic volumes for many intersections near the proposed heavy maintenance facility locations will change due to the presence of a heavy maintenance facility which, in turn, may increase the noise levels along specific roadway segments. The first proposed location for the heavy maintenance facility is on the southeast side of Fresno. The proposed location stretches from the intersection of South Cedar Avenue and South Parkway Drive on the northwest side of the facility to the intersection of South Maple Avenue and East Adams Avenue on the southeast side of the facility.

Table 6-48 lists the Existing and Existing Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the southeast side of Fresno. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one case (SR-99 off-ramp at Clayton Ave.) the peak hour traffic noise will increase by 4 dB.

Table 6-48
Southeast Side of Fresno Existing Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
S. Cedar Ave / E. Central Ave	North	102	102	AM	0
	South	198	198	AM	0
	East	267	270	AM	0
	West	173	176	AM	0
SR 99 SB Off-Ramp / E. Central Ave	North	485	508	AM	0
	South	0	0	AM	n/a
	East	972	1009	AM	0
	West	631	691	AM	0
SR 99 NB On-Ramp / E. Central Ave	North	345	360	AM	0
	South	0	0	AM	n/a
	East	1168	1189	AM	0
	West	943	979	AM	0
S. Chestnut Ave / SR 99 NB Off-Ramp	North	1570	1570	AM	0
	South	1241	1241	AM	0
	East	641	641	AM	0
	West	0	0	AM	n/a
S. Chestnut Ave / SR 99SB On-Ramp	North	626	626	AM	0
	South	495	495	AM	0
	East	185	185	AM	0
	West	0	0	AM	n/a
SR 99 SB Off-Ramp / E. American Ave	North	225	279	AM	1
	South	1	1	AM	0
	East	264	337	AM	1
	West	306	433	PM	2
SR 99 NB On-Ramp / E. American Ave	North	111	147	AM	1
	South	0	0	AM	n/a
	East	281	318	AM	1
	West	256	329	AM	1
S. Chestnut Ave / E. Adams Ave	North	177	179	AM	0
	South	133	135	AM	0
	East	130	130	AM	0
	West	146	146	AM	0

Table 6-48
Southeast Side of Fresno Existing Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
SR 99 SB Off-Ramp / E. Clayton Ave	North	29	29	AM	0
	South	91	194	AM	3
	East	0	0	AM	n/a
	West	74	177	AM	4
SR 99 NB Ramps / S. Clovis Ave	North	911	936	AM	0
	South	658	730	AM	0
	East	348	425	AM	1
	West	97	97	AM	0
S. Clovis Ave / SR 88 SB On-Ramp	North	665	737	AM	0
	South	256	256	AM	0
	East	415	492	PM	1
	West	85	188	AM	3

Table 6-49 lists the Future (2035) No Build and Future (2035) Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the southeast side of Fresno. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one case (SR-99 off-ramp at Clayton Ave.) the peak hour traffic noise will increase by 3 dB.

Table 6-49
Southeast Side of Fresno Year 2035 Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Hourly L_{eq} for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
S. Cedar Ave / E. Central Ave	North	421	421	AM	0
	South	481	481	AM	0
	East	521	524	AM	0
	West	391	394	AM	0
SR 99 SB Off-Ramp / E. Central Ave	North	587	610	AM	0
	South	0	0	AM	n/a
	East	1,238	1,275	AM	0
	West	961	1,021	AM	0
SR 99 NB On-Ramp / E. Central Ave	North	369	384	AM	0
	South	0	0	AM	n/a
	East	1,403	1,424	AM	0
	West	1,154	1,190	AM	0
S. Chestnut Ave / SR 99 NB Off-Ramp	North	1,713	1,713	AM	0
	South	1,241	1,241	AM	0
	East	784	784	AM	0
	West	0	0	AM	n/a
S. Chestnut Ave / SR 99SB On-Ramp	North	1,046	1,046	AM	0
	South	712	712	AM	0
	East	388	388	AM	0
	West	0	0	AM	n/a
SR 99 SB Off-Ramp / E. American Ave	North	252	306	AM	1
	South	1	1	AM	0
	East	830	903	AM	0
	West	867	994	AM	1
SR 99 NB On-Ramp / E. American Ave	North	183	219	AM	1
	South	0	0	AM	n/a
	East	929	966	AM	0
	West	832	905	AM	0
S. Chestnut Ave / E. Adams Ave	North	184	186	AM	0
	South	149	151	AM	0
	East	301	301	AM	0
	West	298	298	AM	0

Table 6-49
Southeast Side of Fresno Year 2035 Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Hourly L_{eq} for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
SR 99 SB Off-Ramp / E. Clayton Ave	North	29	29	AM	0
	South	102	205	AM	3
	East	0	0	AM	n/a
	West	85	188	AM	3
SR 99 NB Ramps / S. Clovis Ave	North	1,756	1,781	AM	0
	South	1,065	1,137	AM	0
	East	796	873	AM	0
	West	97	97	AM	0
S. Clovis Ave / SR 99 SB On-Ramp	North	1,072	1,144	AM	0
	South	291	291	AM	0
	East	874	925	AM	0
	West	99	202	AM	3

The second proposed location for the heavy maintenance facility is on the southeast side of Hanford. The proposed maintenance facility location stretches from the intersection of Houston Avenue and Central Valley Highway (Highway 43) on the northwest side of the facility to the intersection of 7th Avenue and Idaho Avenue on the southeast side of the facility. Table 6-50 lists the Existing and Existing Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the southeast side of Hanford. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one case (SR-43 at Idaho Ave.) the peak hour traffic noise will increase by 2 dB.

Table 6-50
Southeast Side of Hanford Existing Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
SR 43/Houston Avenue	North	682	793	PM	1
	South	516	619	PM	1
	East	300	348	PM	1
	West	192	232	PM	1
7th Avenue/Houston Avenue	North	6	6	PM	0
	South	7	7	PM	0
	East	309	336	PM	0
	West	308	335	PM	0
SR 43/Idaho Avenue	North	484	577	PM	1
	South	471	587	PM	1
	East	45	70	PM	2
	West	38	40	PM	0
7th Avenue/Idaho Avenue	North	6	6	PM	0
	South	7	7	PM	0
	East	44	47	PM	0
	West	45	48	PM	0

Table 6-51 lists the Future (2035) No Build and Future (2035) Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the southeast side of Hanford. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one case (SR-43 at Idaho Ave.) the peak hour traffic noise will increase by 2 dB.

Table 6-51
Southeast Side of Hanford Year 2035 Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Hourly L_{eq} for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
SR 43/Houston Avenue	North	1,134	1,245	AM	0
	South	1,091	1,194	AM	0
	East	238	286	AM	1
	West	291	331	AM	1
7th Avenue/Houston Avenue	North	109	109	AM	0
	South	120	120	AM	0
	East	245	272	AM	0
	West	250	277	AM	0
SR 43/Idaho Avenue	North	1,108	1,201	AM	0
	South	1,092	1,208	AM	0
	East	48	73	AM	2
	West	46	48	AM	0
7th Avenue/Idaho Avenue	North	131	131	AM	0
	South	128	128	AM	0
	East	49	52	AM	0
	West	51	51	AM	0

The third proposed maintenance facility location is on the east side of Wasco. The site is bordered by Highway 46 to the north, J Street to the west, and Filburn Avenue to the south. The east boundary of the facility would be about one-half mile west of Root Avenue. Table 6-52 lists the Existing Conditions and Existing Conditions Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the east side of Wasco. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have either no increase or a 1 dB increase in noise due to the project. In one location (SR-43 at Wasco Ave.) the peak hour traffic noise will increase by 2 dB.

Table 6-52
East Side of City of Wasco Existing Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
SR 43/Wasco Avenue	North	193	286	AM	2
	South	177	306	AM	2
	East	397	469	AM	1
	West	471	579	AM	1
Wasco Avenue - J Street/6th Street	North	176	218	AM	1
	South	164	206	AM	1
	East	3	3	AM	0
	West	39	39	AM	0

Table 6-53 lists the Future (2035) No Build and Future (2035) Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility on the east side of Wasco. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one location (SR-43 at Wasco Ave.) the peak hour traffic noise will increase by 1 dB.

Table 6-53
East Side of City of Wasco Year 2035 Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Hourly L_{eq} for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
SR 43/Wasco Avenue	North	840	933	AM	0
	South	632	761	AM	1
	East	832	904	AM	0
	West	1,374	1,482	AM	0
Wasco Avenue - J Street/6th Street	North	595	637	AM	0
	South	519	561	AM	0
	East	4	4	AM	0
	West	104	104	AM	0

The fourth proposed location for the heavy maintenance facility is in between Shafter and Bakersfield. The proposed maintenance facility would be located on the east side of Santa Fe Way, and would stretch from the intersection of Burbank Street and Mendota Street on the northwest side of the facility to the intersection of 7th Standard Road and Zachary Avenue on the southeast side of the facility. Table 6-54 lists the Existing and Existing Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility at this location. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one location (Santa Fe Way and Burbank St.) the peak hour traffic noise will increase by 9 dB. This is mainly due to the very low existing traffic volumes at that location.

The fifth proposed location for the heavy maintenance facility is on the west side of Santa Fe Way, directly across from the fourth proposed location. This facility would be a mirror image of the one proposed for the east side of the roadway. The change in roadway noise levels associated with this facility are also presented in Table 6-54, and are expected to be the same as for the fourth proposed HMF location.

Table 6-54
City of Shafter/Bakersfield Existing Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Noise Level for AM/PM (dBA)
		Existing Conditions	Existing Conditions Plus Project	AM/PM	
Santa Fe Way/Burbank Street	North	677	767	AM	1
	South	686	776	AM	1
	East	6	51	AM	9
	West	19	64	AM	5
Santa Fe Way/Galpin	North	695	815	AM	1
	South	581	701	AM	1
	East	0	0	AM	n/a
	West	154	154	AM	0

Table 6-55 lists the Future (2035) No Build and Future (2035) Plus Project AM and PM peak hour traffic volumes for intersections that will be affected by the proposed heavy maintenance facility that is located in between Shafter and Bakersfield. The largest change in the hourly L_{eq} for either the AM or PM peak hour traffic volume for each leg of every intersection is listed in the column on the right. The results show that most of the roadways will have no increase in noise due to the project. In one location (Santa Fe Way and Burbank St.) the peak hour traffic noise will increase by 3 dB.

Table 6-55
City of Shafter/Bakersfield Year 2035 Traffic Conditions—Change in Traffic Noise Levels Due to Proposed Heavy Maintenance Facility

Intersection	Legs of Intersection	Peak Hour Traffic Volume			Largest Change in Hourly L_{eq} for AM/PM (dBA)
		Future (2035) No Build	Future (2035) Plus Project	AM/PM	
Santa Fe Way/Burbank Street	North	1,864	1,954	AM	0
	South	1,909	1,999	AM	0
	East	74	119	AM	2
	West	57	102	PM	3
Santa Fe Way/Galpin	North	1,981	2,101	AM	0
	South	1,625	1,745	AM	0
	East	0	0	AM	n/a
	West	470	470	AM	0

6.7 Annoyance and Startle Effects Due to Rapid Onset Rates

6.7.1 Human Noise-Sensitive Receivers

Based on research done by the US Air Force in 1992 that studied aircraft noise annoyance, fast onset rates greater than 15 dB/sec will increasingly annoy humans. The high-speed trains for this HST project will increase up to speeds of 220 mph. At 220 mph, onset rates of 15 dB/sec could annoy human noise-sensitive receivers within a distance of 90 feet from the train.

Startle effects are likely to occur in humans as onset rates approach 30 dB/sec. According to Figure 5-4 of this report, once the high-speed train reaches 220 mph, the onset rate is 30 dB/sec when the noise-sensitive receiver is within a distance of 45 feet from the train.

In order to avoid annoyance to humans from onset rates caused by the high-speed train, noise-sensitive receivers need to be at a distance greater than 90 feet from the track. In order to avoid startle effects at human noise-sensitive receivers due to onset rates, noise-sensitive receivers need to be at a distance greater than 45 feet from the track. Table 6-56 summarizes the human noise-sensitive receiver screening distances for annoyance and startle responses from rapid onset rates.

Table 6-56
Screening Distances for Human Annoyance and Startle Responses
Due to Rapid Onset Rates

Response	Onset Rate Threshold (dB/sec)	Screening Distance (feet)
Annoyance	15	90
Startle	30	45
Source: FRA 2006		

The HST right-of-way will be 100 feet wide, and the distance to the startle effect for humans is 45 feet. As that distance is expected to fall within the right-of-way, there is not expected to be any startle impacts on humans. Annoyance and startle effects should only be considered as additional information for this high-speed impact assessment rather than being a part of a noise exposure calculation. It is too difficult to apply results from aircraft overflights to a high-speed train analysis considering that the two types of sources are very different from one another.

There are (5) identifiable potential noise-sensitive sites along the Alternative Alignment that may be considered as being in close proximity to the startled screening distance. The first noise-sensitive site is located on the southern end of the Fresno Alignment south of E. Malaga Avenue and north of E. American Avenue. This site runs adjacent to the western side of the alignment. The second noise-sensitive site is located on the northern portion of the Hanford East Alignment south of E. Davis Street. The alignment cuts through the northern portion of the property. The third noise-sensitive site is also located on the East Hanford alignment. It is east of 7½ Avenue and north of Fargo Avenue. The alignment cuts through the property. The fourth noise-sensitive site is on the Corcoran Alternative Alignment at the northwest corner of 8th Avenue and Nevada Avenue. It is bordering the western side of the alignment. The fifth noise-sensitive site is located along the Corcoran alignment south of Avenue 136 and runs adjacent to Central Valley Highway. It is bordering the western side of the alignment.

6.7.2 Future (2035) Cumulative Ambient Noise Levels

A noise analysis was also undertaken in order to characterize noise levels for the cumulative condition scenario for the HST project. The cumulative condition scenario is estimated for the year 2035. This analysis includes future impacts generated by the anticipated development and applicable related projects in the project area as well as the proposed HST project. The first step in this analytical process is to identify the future projects in the area near the proposed HST project that could potentially have an incremental effect on the ambient noise levels near noise-sensitive receivers. The second step in this process is to estimate how much each future project will add incrementally to the cumulative noise exposure in the year 2035 at noise-sensitive receivers near the HST project. The third step is to determine if each reasonably foreseeable project is cumulatively significant or not. The final step is to calculate the cumulative noise exposure for the year 2035 at noise-sensitive receivers near the proposed HST project in order to analyze the cumulative noise impacts for the HST project area.

There are many different types of projects that will be completed within the areas near the proposed HST project by 2035. The types of projects that are planned include the expansions of highways and railways, commercial and industrial development, and the construction of new schools and residential areas. It is not possible to estimate how much of an incremental effect that each individual project will have on the cumulative noise exposure. The primary noise sources at noise-sensitive receivers along the HST project corridors are traffic and railway noise sources. In order to analyze the cumulative noise exposure for 2035 for the HST project and other reasonably foreseeable projects, only traffic and railway projects are identified as the two types of projects that will incrementally add to the cumulative noise exposure to the point where it is cumulatively significant. It is not possible to quantify the amount of change that each individual project will make to the cumulative noise exposure in 2035, but it is possible to make a general assessment regarding the increase in noise levels to the two primary noise-contributing sources.

6.7.3 Future Traffic Noise Levels

Traffic noise is considered one of the primary noise sources at noise-sensitive receivers located near the proposed HST project area. There are many different traffic projects that are planned throughout the entire HST project area in the reasonably foreseeable future. Traffic volumes typically increase by 2 percent every year due to the natural increase in population. From the year 2010 to 2035, traffic noise exposure will increase by about 2.2 dBA CNEL at noise-sensitive receivers as the result of the 2 percent annual increase in the traffic volume. The increase of 2.2 dBA CNEL represents the sum of the noise from all planned traffic projects in the reasonably foreseeable future through 2035. It is a safe assumption to say that most of the traffic projects that are planned are a result of the anticipated growth in the community and will be reflected in the increase of 2.2 dBA CNEL in ambient noise levels at noise-sensitive receivers near the HST project area.

6.7.4 Future Railroad Noise Levels

An increase in railroad capacity can also be attributed to natural growth in population and their demands for products. In a report for the proposed BNSF Tehachapi Rail Improvement Project (URS 2008), the capacity for freight trains is proposed to increase from 50 to 65 per day. The total train length capacity would also be increased from 6,000 feet to 8,000 feet. These increases in capacity would result in a 1.3 dBA CNEL increase in future railroad noise exposure at noise-sensitive receivers located near the proposed HST project area.

6.7.5 Future Cumulative Ambient Noise Levels

Future reasonably foreseeable traffic and railway projects will have the most incremental effects on the cumulative ambient noise environment at noise-sensitive receivers in 2035. The estimated contribution from traffic and railway projects to the cumulative noise exposure will result in an increase of 3.5 dBA CNEL in ambient noise levels in areas near the proposed HST project area. An increase of 3.5 dBA is considered to be cumulatively significant. As a result of the increase in ambient noise levels, the cumulative plus HST project noise exposure for the year 2035 will be analyzed.

6.7.6 Cumulative Plus Project Noise Levels

The future existing noise exposures will increase by 3.5 dBA CNEL. The increase of 3.5 dBA CNEL will be applied to all of the noise-sensitive receivers where ambient noise levels were measured for the HST project.

6.7.7 Cumulative Plus Project Noise Impacts

Tables 6-57, 6-58, 6-59, 6-60, 6-61, 6-62, 6-63, 6-64, 6-65, 6-66, 6-67, and 6-68 compare the existing FRA impacts on the 2035 cumulative impacts for each proposed HST segment. The level of impact and number of noise-sensitive receivers that are expected to be impacted are listed for both the existing case and 2035 cumulative impact case. At most noise-sensitive receivers, the level of impact does not change when the 2035 cumulative noise ambient noise levels are taken into account. In some cases, the severity of the noise impact at noise-sensitive receivers may change from "severe" to "moderate" or from "moderate" to "none" due to the increase in ambient noise levels caused by the introduction of reasonably foreseeable future traffic and railway projects. The addition of 3.5 dBA CNEL to the ambient noise levels may lessen the severity of impacts at some noise-sensitive receivers, but will not change the level of impact at most noise-sensitive receivers located near the proposed HST project corridors. The values in these tables summarize the number of FRA impacts by noise analysis site as listed in the Operation Noise Level tables (i.e., Tables 6-2 to 6-26) presented earlier in this chapter.

Table 6-57
BNSF Alternative through Fresno Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	8	6
Moderate	34	24
None	11	23
*with no mitigation		

Table 6-58
BNSF Alternative Hanford – East Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	35	25
Moderate	32	32
None	8	18
*with no mitigation		

Table 6-59
BNSF Alternative through Corcoran - Elevated Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	6	1
Moderate	18	20
None	8	11
*with no mitigation		

Table 6-60
BNSF Alternative through Corcoran Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	**2035 Cumulative FRA Impact***
Severe	6	1
Moderate	18	20
None	8	11
*with no mitigation		

Table 6-61
Corcoran Bypass Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	**2035 Cumulative FRA Impact***
Severe	10	7
Moderate	3	5
None	19	20
*with no mitigation		

Table 6-62
BNSF Alternative through Pixley Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	**2035 Cumulative FRA Impact***
Severe	0	0
Moderate	5	4
None	3	4
*with no mitigation		

Table 6-63
BNSF Alternative through Allensworth Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	13	10
Moderate	15	11
None	11	18
*with no mitigation		

Table 6-64
Allensworth Bypass Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	6	4
Moderate	5	4
None	28	31
*with no mitigation		

Table 6-65
BNSF Alternative through Wasco-Shafter Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	6	3
Moderate	30	28
None	55	60
*with no mitigation		

Table 6-66
Wasco-Shafter Bypass Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	7	6
Moderate	28	21
None	59	67
*with no mitigation		

Table 6-67
BNSF Alternative through Bakersfield - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	34	21
Moderate	37	45
None	39	44
*with no mitigation		

Table 6-68
Bakersfield South Alignment - Existing FRA Impacts vs. 2035 Cumulative FRA Impacts

FRA Level of Impact	Number of Noise-Sensitive Analysis Sites	
	Existing FRA Impact*	2035 Cumulative FRA Impact*
Severe	31	20
Moderate	42	40
None	37	50
*with no mitigation		

Section 7.0

Mitigation Analysis

7.0 Mitigation Analysis

Analysis of the proposed project including the various alternatives shows the potential for moderate and severe noise impacts on some of the noise-sensitive land uses to be located near the project right-of-way. Mitigation measures were calculated for each of these potentially impacted sensitive receivers in each segment of the project alignment for each alternative. Noise mitigation measures were calculated for each location where severe project related noise impacts were calculated.

Noise exposure levels and the corresponding noise mitigation measures were calculated for a receiver located at the ground floor of the individual land use. Receivers located in exterior spaces such as balconies or decks which are on the second or higher floors would be subject to unmitigated and mitigated noise levels slightly higher than those listed here. The closer the receiver is to the source, the more dramatic the increase in noise level would be as the elevation of the receiver increases.

7.1 Noise Mitigation Guidelines

In general, noise mitigation must be considered when impacts are identified. Mitigation guidelines for the three impact categories identified by FRA are as follows:

- No Impact: No mitigation required.
- Moderate Impact: Mitigation may be considered at the discretion of the Authority, and implementation would be subject to reasonable project-specific factors related to effectiveness, cost, density, and proximity of sensitive receptors.
- Severe Impact: Consideration of mitigation is required if impacts cannot be avoided. The Authority will take steps to reduce noise substantially through mitigation measures that are reasonable, physically feasible, practical, and cost-effective.

7.1.1 Mitigation of Severe Noise Impacts

The Authority will examine alternatives to avoid, minimize, or mitigate severe noise impacts. If severe noise impacts cannot be avoided, then the Authority will take steps to reduce severe noise substantially through mitigation measures that are reasonable, physically feasible, practical, and cost-effective. The following criteria will be used for evaluating the reasonableness of noise barriers as mitigation for severe noise impacts:

- Calculations and Computations for barrier geometry as stated in the FRA High Speed Noise and Vibration assessment, Table 5-3.
- Increase over existing noise levels.
- Number of noise-sensitive sites affected.
- The minimum number of affected sites should be at least 10, and the length of a noise barrier should be at least 800 feet.
- Barrier heights up to a maximum of 14 feet will be considered. Mitigation options for areas that require barriers over 14 feet will be studied on a case by case basis.
- The cost limit for a noise barrier would be set at $45,000 (2010 dollars) per benefited residence.

- The community should approve of implementation of the recommended noise barriers (75% of all affected parties).

Section 4(f) and Section 106 properties with severe or moderate noise impacts will require mitigation, will not be subject to these guidelines, and will be evaluated on a case-by-case basis.

7.1.2 Substantial Noise Reduction

A minimum outdoor noise reduction of 5 decibels (dB) using the applicable criterion for the property is considered substantial.

7.1.3 Reasonable

Reasonableness implies that good judgment and common sense have been applied during the decision-making process. Reasonableness is determined on the basis of several factors regarding the individual circumstances and the specific needs of affected receivers.

7.1.4 Physically Feasible

Noise mitigation measure must be designed, constructed, installed, or implemented in compliance with structural requirements related to ground conditions, wind loading, seismic risk, safety considerations, accessibility, material maintainability and longevity, and applicable engineering design practices and technology. Noise mitigation measures must not result in an adverse environmental impact, such as significant visual intrusions, blocked views, or adverse effects to a historical site.

Sound barriers are the most common noise mitigation measure. The maximum sound barrier height would be 14 feet for at-grade sections; however, all sound barriers should be designed to be as low as possible to achieve a substantial noise reduction. Berm and berm/wall combinations are the preferred types of sound barriers where space and other environmental constraints permit.

On aerial structures, the maximum sound barrier height would also be 14 feet, but barrier material would be limited by engineering weight restrictions for barriers on the structure. Sound barriers on the aerial structure should still be designed to be as low as possible to achieve a substantial noise reduction.

7.1.5 Visual effects

Noise mitigation measures must be designed, constructed, installed, and implemented in a manner that does not result in adverse impacts on the visual resources in the area. Sound barriers will consist of a solid barrier no more than 6 feet in height. Above 6 feet, the sound barrier will be made of transparent materials. For example, a 13-foot-high sound barrier would consist of 6 feet of solid material on the bottom topped by 7 feet of transparent material.

7.1.6 Cost Effectiveness

The cost for constructing a noise barrier along the at-grade portion of the alignment is estimated to be $36 per square foot, and the cost to construct a noise barrier along the elevated portion of the alignment is $30 per square foot. The total cost of mitigation cannot exceed $45,000 per benefitted receptor. This cost is determined by dividing the total cost of the mitigation measure by the number of noise-sensitive buildings that receive a substantial (i.e., 5 dBA or greater) outdoor noise reduction. This calculation will generally limit the use of mitigation in rural areas that have few and/or isolated residential buildings. If the density of residential dwellings is insufficient to make the measure cost-effective, then other noise abatement measures, such as sound insulation, will be considered on a case-by-case basis. If sound insulation is identified as an alternative mitigation measure, the treatment must provide a substantial increase in noise reduction (i.e., 5 dBA or greater) between the outside and inside noise levels for interior habitable rooms.

7.2 Mitigation Measures

Noise barriers were modeled for each noise-sensitive receiver that would be subject to a severe impact due to project operations. Those noise barriers were screened using the parameters previously described and the resulting noise barriers are presented by project segment. Proposed locations for the noise barriers are shown in the figures in Appendix H.

7.2.1 BNSF Alternative Alignment Through Fresno

This portion of the project alignment extends from the west end of the Fresno station at Stanislaus Street to just north of E. Lincoln Avenue. There would be a total of 20 severely impacted sites located along the west and east sides of this section of alignment that would not meet the screening criteria listed above, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.2 BNSF Alternative Alignment Hanford - East

This portion of the project alignment extends from just north of E. Lincoln Avenue down to just north of Idaho Avenue. There would be a total of 333 severely impacted sites located along the west and east sides of this section of alignment that would not meet the screening criteria listed above, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.3 BNSF Alternative Alignment Through Corcoran

This portion of the project alignment extends from just north of Idaho Avenue to just northwest of the intersection of Avenue 128 and Road 32. The results of the noise barrier analysis for this alignment are presented in Table 7-1. The Corcoran Alignment Barrier 1 would be located on the southbound side of the alignment from north of Newark Avenue to south of Oregon Avenue. The total length of this barrier would be approximately 18,000 feet at a height of 14 feet. This barrier would benefit approximately 377 residential receivers. The Corcoran Alignment Barrier 1A would be located on the northbound side of the alignment from north of Newark Avenue to south of Sherman Avenue. The total length of the barrier would be approximately 10,500 feet at a height of 14 feet. This barrier would benefit approximately 118 residential receivers. There would be a total of 45 severely impacted sites located along the west and east sides of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.4 Corcoran Bypass Alternative

This portion of the project alignment extends from just north of Idaho Avenue to just northwest of the intersection of Avenue 128 and Road 32. There would be a total of 233 severely impacted sites located along the west and east sides of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.5 Corcoran Elevated Alternative

This portion of the project alignment extends from Niles Avenue to 4th Avenue. The results of the noise barrier analysis for this alignment are presented in Table 7-2. The Corcoran Alignment Barrier 1 would be located on the southbound side of the alignment north of Newark Avenue to south of Oregon Avenue. The total length of the barrier would be approximately 18,000 feet at a height of 14 feet. This barrier would benefit approximately 581 receivers.

The Corcoran Alignment Barrier 1A would be located on the northbound side of the alignment north of Newark Avenue to south of Sherman Avenue. The total length of the barrier would be approximately 14,000 feet long, at a height of 14 feet. This barrier would benefit approximately 160 receivers..

7.2.6 BNSF Alternative Alignment Through Pixley

This portion of the project alignment extends from the intersection of Avenue 128 and Road 32 to southwest of Avenue 84. There would be a total of two severely impacted sites located along the west side of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.7 BNSF Alternative Alignment Through Allensworth

This portion of the project alignment extends from just southwest of Avenue 84 to just northwest of Whisler Road. There would be a total of 31 severely impacted sites located along the west and east sides of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

7.2.8 Allensworth Bypass Alternative

This portion of the project alignment extends from just south of Avenue 84 to just south of Elmo Highway. There would be no severely impacted sites located along this section of alignment..

Table 7-1
Barrier Locations Through Corcoran

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $45,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
BNSF Alternative Alignment Through Corcoran												
North of Newark Ave. to south of Oregon Ave.	Southbound track	1	At-grade	18,000	14	252,000	$9,072,000	536	$16,925	No	Yes	0
North of Newark Ave. to south of Sherman Ave.	Northbound track	1A	At-grade	10,500	14	147,000	$5,292,000	118	$44,847	No	Yes	0

Table 7-2
Barrier Locations Through Corcoran Elevated Alternative

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $45,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
Corcoran Elevated Alternative												
North of Newark Ave. to south of Oregon Ave.	Southbound track	1	Aerial	18,000	14	252,000	$7,560,000	579	$13,057	No	Yes	0
North of Newark Ave. to south of Sherman Ave.	Northbound track	1A	Aerial	14,00	14	196,000	$5,880,000	158	$37,215	No	Yes	0

7.2.9 BNSF Alternative Alignment Through Wasco-Shafter

This portion of the project alignment extends from just northwest of Whisler Road to the intersection of Hageman Road and Rosedale Lane. The noise barrier results for this segment are presented in Table 7-3. The BNSF Alignment Wasco-Shafter Barrier 1 would be located on the southbound side of the alignment from north of McCombs Avenue to south of Jackson Avenue. The total length of the barrier would be approximately 16,031 feet at a height of 14 feet. This barrier would benefit approximately 617 receivers. The BNSF Alignment Wasco-Shafter Barrier 2 would be located in the City of Shafter, on the southbound side of the alignment from Mayer Lane running south ending south of East Los Angeles Avenue. The total length of the barrier would be approximately 14,572 feet at a height of 14 feet. This barrier would benefit approximately 439 receivers. The BNSF Alignment Wasco-Shafter Barrier 3 is located on the southbound side of the alignment south of Renfro Road to Hageman Road. The total length of the barrier would be approximately 3,924 feet long, at a height of 14 feet. This barrier would benefit approximately 61 receivers.

The BNSF Alignment Wasco-Shafter Barrier 4 would be located on the northbound side of the alignment south of Paso Robles Highway (Hwy 46) to south of Poso Avenue. The total length of the barrier would be approximately 5,188 feet at a height of 14 feet. This barrier would benefit approximately 209 receivers. The BNSF Alignment Wasco-Shafter Barrier 5 would be located in the City of Shafter, on the northbound side of the alignment from south of Fresno Avenue south to East Ash Avenue. The total length of the barrier would be approximately 9,955 feet at a height of 14 feet. This barrier would benefit approximately 335 receivers. The BNSF Alignment Wasco-Shafter Barrier 6 would be on the northbound side of the alignment from north of Reina Road to Hageman Road. The total length of the barrier would be approximately 7,359 feet at a height of 14 feet. This barrier would benefit approximately 126 receivers. There would be a total of 60 severely impacted sites located along the west and east sides of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements.

Table 7-3
Barrier Locations Through Wasco-Shafter

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $45,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
BNSF Alternative Alignment Through Wasco-Shafter												
City of Wasco-McCombs Ave south to Jackson Ave.	Southbound track	1	Aerial	16,031	14	224,434	$6,733,020	614	$10,966	No	Yes	2
City of Shafter - North of Mayer Ln. at the north of Shafter south ending before E. Los Angeles Ave.	Southbound track	2	Aerial	15,063	14	210,882	$6,326,460	454	$13,935	No	Yes	52
South of Renfro Rd. Hageman Rd.	Southbound track	3	At-grade	3,924	14	54,936	$1,977,696	61	$32,421	No	Yes	5
South of Paso Robles Hwy (46) to south of Poso Ave. (Wasco)	Northbound track	4	Aerial	5,188	14	72,632	$2,178,960	226	$9641	No	Yes	1
South of Fresno Ave. to north of Beech Ave. (Shafter)	Northbound track	5	Aerial	9,955	14	139,370	$4,181,100	350	$11,946	No	Yes	0
(Belsera) north of Reina Rd. to Hageman Rd.	Northbound track	6	Aerial	7,359	14	103,026	$3,090,780	126	$24,530	No	Yes	0

7.2.10 Wasco-Shafter Bypass Alternative

This portion of the project alignment extends from just northwest of Whisler Road to the intersection of Hageman Road and Rosedale Lane. The Wasco-Shafter Bypass Alternative Barrier 1 is located on the southbound side of the alignment south of Renfro Road to Hageman Road. The total length of the barrier would be approximately 3,950 feet, at a height of 14 feet. This barrier would benefit approximately 61 receivers. The Wasco-Shafter Bypass Alternative Barrier 2 would be located on the northbound side of the alignment in Belsera, north of Reina Road to Hageman Road. The total length of the barrier would be approximately 7,359 feet at a height of 14 feet. This barrier would benefit approximately 126 receivers. There would be a total of 5 severe noise sites located along the west and east sides of this section of alignment that would not meet the noise barrier screening criteria, and as such these sites would not be eligible for noise barriers, but are eligible to receive sound insulation or payment of property noise easements. The noise barrier results for this segment are presented in Table 7-4.

7.2.11 BNSF Alternative Alignment Through Bakersfield

This portion of the project alignment extends from the intersection of Hageman Road and Rosedale Lane past the east end of the proposed station in downtown Bakersfield to Baker Street. The BNSF Alternative Alignment Bakersfield Barrier 1 would be located on the southbound side of the alignment at Hageman Road to north of Palm Avenue. The total length of this barrier would be approximately 12,135 feet at a height of 14 feet. This barrier would benefit approximately 548 receivers. The BNSF Alternative Alignment Bakersfield Barrier 2 would be located on the southbound side of the alignment north of Palm Avenue to south of Coffee Road. The total length of this barrier would be approximately 9,654feet at a height of 14 feet. This barrier would benefit approximately 404 receivers. The BNSF Alternative Alignment Bakersfield Barrier 3 would be located on the southbound side of the alignment west of Interstate 99 to north of Baker Street. The total length of this barrier would be approximately 14,964 feet at a height of 14 feet. This barrier would benefit approximately 364 receivers.

The BNSF Alternative Alignment Bakersfield Barrier 4 would be located on the northbound side of the alignment from Hageman Road to north of Palm Avenue. The total length of this barrier would be approximately 6,466 feet at a height of 14 feet. This barrier would benefit approximately 602 receivers. The BNSF Alternative Alignment Bakersfield Barrier 5 would be located on the northbound side of the alignment from north of Palm Avenue to south of Calloway Drive. The total length of this barrier would be approximately 6,114 feet at a height of 14 feet. This barrier would benefit approximately 202 receivers. The BNSF Alternative Alignment Bakersfield Barrier 6 would be located on the northbound side of the alignment from west of Interstate 99 to Chester Avenue. The total length of the barrier would be approximately 7,808 feet at a height of 14 feet. This barrier would benefit approximately 278 receivers. The BNSF Alternative Alignment Bakersfield Barrier 7 would be located on the northbound side of the alignment north of Q Street to north of Baker Street. The total length of this barrier would be approximately 4,842 feet at a height of 14 feet. This barrier would benefit approximately 72 receivers. The noise barrier results for this portion of the alignment are presented in Table 7-5.

Table 7-4
Barrier Location – Wasco-Shafter Bypass

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $60,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
Wasco-Shafter Bypass Alternative												
South of Renfro Rd. Hageman Rd.	Southbound track	1	At-grade	3,950	14	55,300	$1,990,800	61	$32,636	No	Yes	5
(Belsera) north of Reina Rd. to Hageman Rd.	Northbound track	2	At-grade	7,359	14	103,026	$3,708,936	126	$29,436	No	Yes	0

Table 7-5
Barrier Locations – BNSF Alternative Alignment Through Bakersfield

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $45,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
BNSF Alternative Alignment Through Bakersfield												
Hageman Road to north of Palm Ave	Southbound track	1	At-grade		14	169,890	$6,116,040	543	$11,263	No	Yes	0
North of Palm Ave. to south Coffee Rd.	Southbound track	2	Aerial		14	135,156	$4,054,680	402	$10,086	No	Yes	0
West of Interstate 99 to Baker St.	Southbound track	3	Aerial		14	209,496	$6,284,880	362	$17,362	No	Yes	0
Hageman Rd. to north of Palm Ave.	Northbound track	4	At-grade	6,466	14	90,524	$3,258,864	600	$5,431	No	Yes	0
North of Palm Ave. to south of Calloway Dr.	Northbound track	5	Aerial	6,114	14	85,596	$2,567,880	200	$12,839	No	Yes	0
West of Interstate 99 to Chester Ave.	Northbound track	6	Aerial	7,808	14	109,312	$3,279,360	276	$11,882	No	Yes	0
Q St. to west of Baker St.	Northbound track	7	Aerial	4,842	14	67,788	$2,033,640	70	$29,052	No	Yes	0

7.2.12 Bakersfield South Alternative

This portion of the project alignment extends from the intersection of Hageman Road and Rosedale Lane past the east end of the proposed station in downtown Bakersfield to Baker Street. The Bakersfield South Alternative Barrier 1 would be located on the southbound side of the alignment from Hageman Road to north of Verdugo Lane. The total length of this barrier would be approximately 12,189 feet at a height of 14 feet. This barrier would benefit approximately 326 receivers. The Bakersfield South Alternative Barrier 2 would be located on the southbound side of the alignment from north of Verdugo Lane to south of Coffee Road. The total length of this barrier would be approximately 10,425 feet at a height of 14 feet. This barrier would benefit approximately 425 receivers. The Bakersfield South Alternative Barrier 3 would be located on the southbound side of the alignment west of Interstate 99 to south of Baker Street. The total length of this barrier would be approximately 14,964 feet at a height of 14 feet. This barrier would benefit approximately 632 residential receivers.

The Bakersfield South Alternative Barrier 4 would be located on the northbound side of the alignment from Hageman Road to north of Verdugo Lane. The total length of this barrier would be approximately 12,189 feet at a height of 14 feet. This barrier would benefit approximately 670 receivers. The Bakersfield South Alternative Barrier 5 would be located on the northbound side of the alignment from north of Verdugo Lane to south of Coffee Road. The total length of this barrier would be approximately 6,466 feet at a height of 14 feet. This barrier would benefit approximately 157 receivers. The Bakersfield South Alternative Barrier 6 would be located on the northbound side of the alignment west of Highway 99 to Chester Avenue. The total length of this barrier would be approximately 7,808 feet at a height of 14 feet. This barrier would benefit approximately 276 receivers. The Bakersfield South Alignment Barrier 7 would be located on the northbound side of the alignment from north of Q Street to south of Baker Street. The total length of this barrier would be approximately 4,842 feet at a height of 14 feet. This barrier would benefit approximately 254 receivers. The noise barrier results for this portion of the alignment are presented in Table 7-6.

Table 7-6
Barrier Locations – Bakersfield South Alternative

Receptor Location	Track	Barrier Number	Aerial or At-grade	Total Length (feet)	Barrier Height	Area (sq. ft.)	Total Cost ($)	Impacted or Benefitted Receivers	Cost per Benefitted Receiver	Cost Exceed $45,000?	Is Barrier Reasonable?	Number of Severe Residual Impacts
Bakersfield South Alternative												
Hageman Road to south of Palm Ave	Southbound track	1	At-grade	12,189	14	170,646	$6,143,256	326	$18,844	No	Yes	0
South of Verdugo Ln. to south of Coffee Rd.	Southbound track	2	Aerial	10,425	14	145,950	$4,378,500	425	$10,302	No	Yes	0
West of Interstate 99 to Baker St.	Southbound track	3	Aerial	14,964	14	209,496	$6,284,880	632	$17,362	No	Yes	0
Hageman Road to north of Verdugo Lane.	Northbound track	4	At-grade	12,189	14	170,646	$6,143,256	670	$9,169	No	Yes	0
North of Verdugo Lane to south of Coffee Rd.	Northbound track	5	Aerial	6,466	14	90,524	$2,715,720	157	$17,289	No	Yes	0
West of Interstate 99 to Chester Ave.	Northbound track	6	Aerial	7,808	14	109,312	$3,279,360	276	$11,882	No	Yes	0
Q St. to east of Baker St.	Northbound track	7	Aerial	4,842	14	67,788	$2,033,640	254	$8,006	No	Yes	0

7.3 Unmitigated Severely Impacted Noise-sensitive Land Uses

Noise Insulation Program

The BNSF Alternative Alignment segments and the alternative alignment segments listing the affected land uses are presented in Tables 7-7 through 7-12 . The tables list the total unmitigated land uses that are not mitigated by noise barriers. These noise-sensitive receivers are the remaining affected noise-sensitive receivers that were not eligible for noise barriers due to parameters in the screening procedure.

Table 7-7
Residual Severe Noise Impacts Post Mitigation– BNSF Alternative

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
BNSF - Fresno	F4	20	0	0	0	0	15
BNSF - Hanford East	H2	329	3	0	1	0	2
BNSF Corcoran	C3	45	0	0	0	0	2
BNSF - Pixley	P	2	0	0	0	0	0
BNSF Allensworth	A2	30	0	0	0	1	4
BNSF Wasco-Shafter	WS4	491	0	0	0	0	6
BNSF Bakersfield	B1	0	0	0	0	0	16
Totals		523	10	1	27	4	45

Table 7-8
Residual Severe Noise Impacts Post Mitigation – Corcoran Bypass

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
Corcoran Bypass	C4	231	2	0	0	0	0

Table 7-9
Residual Severe Noise Impacts Post Mitigation – Corcoran Elevated

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
Corcoran Elevated	CE	0	0	0	0	0	0

Table 7-10
Residual Severe Noise Impacts Post Mitigation – Allensworth Bypass

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
Allensworth Bypass	A1	0	0	0	0	0	1

Table 7-11
Residual Severe Noise Impacts Post Mitigation – Wasco-Shafter Bypass

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
Wasco-Shafter Bypass	WS2	192	0	0	0	0	2

Table 7-12
Residual Severe Noise Impacts Post Mitigation – Bakersfield South

Segment Name	Segment ID	Residential	Schools	Hospitals	Churches	Parks	Historic
Bakersfield South	B2	0	0	0	0	0	16

7.3.1 Outdoor-to-Indoor Noise Reduction

Sound insulation of residences and institutional buildings to improve the outdoor-to-indoor noise reduction is a mitigation measure that can be provided when the use of noise barriers cannot provide a feasible level (5 to 7 dB) of noise reduction. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where noise barriers are not feasible or desirable and for buildings where indoor sensitivity is of most concern. Substantial improvements in building sound insulation (on the order of 5 to 10 dB) can often be achieved by adding an extra layer of glazing to windows, by sealing holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened. Performance criteria should be established to balance existing noise events and ambient roadway noise conditions as factors for determining mitigation measures.

7.3.2 Purchasing of Homes

Current severe noise impacted land uses not mitigated by barriers would require the consideration of some type of attenuation. In the event that sound insulation of residential buildings cannot improve the indoor-to outdoor noise reduction it is not unreasonable to consider that the purchase of the land use area could be an option.

7.3.3 Noise Easements

In the case that a substantial noise reduction cannot be completed and the property owner does not choose to vacate their property or relocate, an agreement between the Authority and the property owner can be established wherein the property owner has released the right to petition the Authority regarding the noise level and subsequent disruptions. The easement shall encompass the property boundaries to grant the right-of-way of the rail line.

7.3.4 Special trackwork at crossovers and turnouts

Because the impact of HST wheels over rail gaps at turnouts increase HST noise by approximately 6 dB, turnouts can be a major source of noise impact. If the turnouts cannot be moved from sensitive areas, the project will use trackwork designs such as spring loaded or moveable point frogs that eliminate the gap.

7.3.5 Traction Power Substation

In order to mitigate the noise from the three potential traction power substations located within 250 of noise-sensitive land uses, should any of these facilities be chosen, they should be mitigated by an 8 foot barrier located around the perimeter of the facility.

7.3.6 Vibration Mitigation

After all of the components of the equation that defines vibration levels at sensitive receivers caused by train sources have been calculated, the Detailed Vibration Assessment and General Vibration Assessment are examined in order to determine if there will be any impacts due to vibration. If there are vibration impacts at sensitive receivers, mitigation must be considered.

For existing rail, adequate wheel and rail maintenance are very important in preventing vibration impacts. Rough wheels and rails can increase vibration levels by as much as 20 VdB, which can negate any vibration control measures. It is rare when practical vibration control measures provide up to 15 to 20 VdB in attenuation. When possible, it is best to grind rough or corrugated rail and implement wheel truing to restore the wheel surface and contour. This may reduce vibration more than completely replacing the existing track system with floating slabs.

If the train, railway and railway structures are in good condition, then other mitigation methods must be examined. Mitigation will fit into one of the categories found in Table 7-13. The table lists where the mitigation procedure will take place. Mitigation can take place at the source, sensitive receiver, or along the propagation path from the source to the sensitive receiver. A description of each type of mitigation procedure can also be found in Table 7-13.

Table 7-13
Possible Mitigation Procedures and Descriptions

Mitigation Procedure	Location of Mitigation	Description
Maintenance	Source	Rail condition monitoring systems with rail grinding on a regular basis. Wheel truing to re-contour the wheel, provide a smooth running surface and remove wheel flats. Reconditioning vehicles. Installing wheel condition monitoring systems.
Location and Design of Special Trackwork	Source	Careful review of crossover and turnout locations during the preliminary engineering stage. When feasible, relocate special trackwork to a less vibration-sensitive area. Installation of spring frogs eliminates gaps at crossovers and helps reduce vibration levels.
Vehicle Suspension	Source	Rail vehicle should have low unsprung weight, soft primary suspension, minimum metal-on-metal contact between moving parts of the truck, and smooth wheels that are perfectly round.
Special Track Support Systems	Source	Floating slabs, resiliently supported ties, high resilience fasteners, resilient sub-roadbed materials, and ballast mats all help reduce vibration levels from track support system.
Building Modifications	Receiver	For existing buildings, if vibration-sensitive equipment is affected by train vibration, the floor upon which the vibration-sensitive equipment is located could be stiffened and isolated from the remainder of the building. For new buildings, the building foundation should be supported by elastomer pads similar to bridge bearing pads.

Table 7-13
Possible Mitigation Procedures and Descriptions

Mitigation Procedure	Location of Mitigation	Description
Trenches	Along Vibration Propagation Path	A trench can be an effective vibration barrier if it changes the propagation characteristics of the soil. It can be open or solid. Open trenches can be filled with styrofoam. Solid barriers can be constructed with sheet piling, rows of drilled shafts filled with either concrete or a mixture of soil and lime, or concrete poured into a trench.
Operational Changes	Source	Reduce vehicle speed. Adjust nighttime schedules to minimize train movements during sensitive hours. Operating restrictions requires continuous monitoring and may not be practical.
Buffer Zones	Receiver	Negotiate a vibration easement from the affected property owners or expand rail right-of-way.

Section 8.0

Construction Noise Prediction and Methodology

8.0 Construction Noise Prediction and Methodology

8.1 Construction Noise

High-Speed Train Project construction would result in a temporary increase in the ambient noise level. Noise would result from the operation of the various types of construction equipment expected to be used during the development of this project. The increased noise level would be primarily experienced close to the noise source, at the noise-sensitive receivers in the vicinity of the project site. The magnitude of the impact would depend on the type of construction activity, the volume of construction equipment, the noise level generated by various pieces of construction equipment, the duration of the construction phase, and the distance between the noise source and receiver. All of these factors are important in determining the potential impacts on any noise-sensitive land uses due to construction. The construction phases of the high-speed train corridor will involve mobilization, site preparation, earth moving, construction of grade separations, construction of elevated track structures, track laydown, and demobilization. There are currently five alternatives for the location of the heavy maintenance facility. There are also three locations for train stations. The construction phases and list of equipment that will be utilized during construction of the heavy maintenance facility and train stations have not been provided at this time. It is safe to assume that the construction phases for the heavy maintenance facility and train stations will follow those used in many public works projects.

Table 8-1 lists the average sound pressure level from a distance of 50 feet for the five construction phases for typical public works projects. These phases include ground clearing, excavation, foundation construction, erection of the facility/station, and site cleanup and demobilization.

Table 8-1
Typical Noise Levels from Construction Activities for Public Works Projects

Construction Activity	Average Sound Level* at 50 feet (dBA L_{eq})	Standard Deviation (dBA)
Ground Clearing	84	7
Excavation	89	6
Foundations	78	3
Erection	87	6
Finishing	89	7

*Sound level with all pertinent equipment operating.
Source: EPA1971

Table 8-2 presents typical construction noise levels for various pieces of construction equipment at a distance of 50 feet. The sound levels will be attenuated with distance from the source by a variety of mechanisms, but the most significant of these mechanisms is the diversion of sound waves with distance from the source (attenuation by divergence). In general, there will be a 6 dBA decrease in the sound level with every doubling of distance from the source. Therefore, at a distance of 100 feet, the noise levels will be about 6 dBA lower than at the 50-foot reference distance. Similarly, at a distance of 200 feet, the noise levels would be approximately 12 dBA lower than at the 50-foot reference distance.

Table 8-2
Noise Level of Typical Construction Equipment at 50 feet (dBA Lmax)*

Air Compressor	81
Auger Drill Rig**	85
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane Derrick	88
Crane Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

* Source: FTA [1995] 2006, Table 12-1.

** Source: FHWA Road Construction Noise Model

Noise from construction activity is generated by the broad array of powered noise-producing mechanical equipment used in the construction process. This equipment ranges from hand-held pneumatic tools to scrapers, bulldozers, dump trucks, and tie and rail handling equipment. The construction schedule and list of equipment that will utilized during the construction of the railway corridor are provided in Appendix I. Noisy construction activities could be in progress at more than one part of the project site at a given time. However, the noise levels from construction activity during various phases of a typical construction project have been evaluated, and their use provides an acceptable prediction of a project's potential construction noise impacts.

It is assumed that construction will likely occur seven days a week between the hours of 7:00 a.m. and 7:00 p.m. Some construction activities may be conducted outside of construction noise exempt times that are found in the applicable local noise standards. Likely exceptions to the assumed construction times include construction over a freeway (SR 41, SR 99, SR 180) or over an active heavy rail line. Work is assumed to occur at night for these activities in order to limit impacts on freight and highway traffic. Rural areas will likely not have construction conducted nearby during nighttime hours due to higher construction costs.

8.2 Construction Criteria

There are no standardized construction noise criteria from the FTA, or FRA, for assessing noise impacts at sensitive receivers due to construction. The FRA Manual does outline general assessment and detailed assessment criteria if local ordinances and standards are not in place. Local ordinances and standards will always have precedence over the "reasonable guidelines" established by the FRA. Local ordinances and standards can be found in Section 3.0 of this report. A summary of the local construction noise standards and construction noise exemption times for all of the counties and cities that may be impacted by the high speed train project can be found in Table 8-3. The "reasonable guidelines" established by the FRA are deliberately conservative in order to avoid adverse community reaction.

Table 8-3
Construction Noise Standards for Counties and Cities

Jurisdiction	Construction Noise Standards
County of Fresno	Construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 7:00 a.m. to 5:00 p.m.
County of Kings	Construction noise is exempt from local noise standards from 7:00 a.m. to 7:00 p.m. on weekdays and from 9:00 a.m. to 6:00 p.m. on Saturday and Sunday
County of Tulare	Construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m.
County of Kern	Construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m.
City of Fresno	Construction noise is exempt from local standards from 7:00 a.m. to 10:00 p.m. Monday through Saturday and it is not exempt on Sunday
City of Hanford	In a phone conversation on March 4, 2010, Mr. Jim Kochar (Chief Building Official, City of Hanford) stated that typical construction noise exempt times for the City of Hanford are all days of the week from 7:00 a.m. to 5:00 p.m.
City of Corcoran	Construction noise is exempt from local standards every day from 6:00 a.m. to 7:00 p.m.
City of Delano	It is unlawful for any person within a residential zone, or within a radius of 300 feet therefrom, to operate equipment or perform any outside construction or report work on buildings, structures or projects or to operate any pile driver, steam shovel, pneumatic hammer, derrick, steam or electric hoist, or other construction type device in such a manner that noise is produced which would constitute a violation of Section 9.36.040, unless beforehand a permit therefor has been duly obtained from the building division. No permit shall be required to perform emergency work as defined in Article I of this chapter." (City of Delano Noise Ordinance, 1986). A permit should be obtained from the City of Delano's building division before construction begins near the vicinity of the City of Delano.

Table 8-3
Construction Noise Standards for Counties and Cities

Jurisdiction	Construction Noise Standards
City of Wasco	In a phone conversation on March 4, 2010, Ms. Duviet Rodriguez (Executive Assistant to the City Manager, City of Wasco) stated that typical construction noise exempt times for the City of Wasco are from 7:00 a.m. to 7:00 p.m. on weekdays and from 9:00 a.m. to 6:00 p.m. on Saturdays and Sundays.
City of Shafter	Within a residential zone, or within a radius of 500 feet therefrom, no person shall operate equipment, for the construction or repair of buildings, structures or projects, which creates noise exceeding the ambient noise level beyond 50 feet from the source between the hours of 7:00 p.m. and 7:00 a.m.
City of Bakersfield	Construction noise is exempt from local noise standards on weekdays from 6:00 a.m. to 9:00 p.m. and on Saturday and Sunday from 8:00 a.m. to 9:00 p.m.

The purpose of the general assessment for construction noise is to identify land uses in the vicinity of the project where construction will occur. The land uses are categorized by residential, commercial and industrial land uses. The general assessment recommends combining the noise levels from the two noisiest pieces of construction equipment assuming that they are running at the same time. According to the general assessment, the noise levels should not exceed the criteria found in Table 8-4. The general assessment criteria for construction noise prescribe different levels for daytime and nighttime construction. Daytime is defined as 7:00 a.m. to 10:00 p.m. and nighttime is defined as 10:00 p.m. to 7:00 a.m.

A detailed assessment for construction will predict noise levels in terms of an 8-hour L_{eq} and 30-day averaged L_{dn}. According to the detailed assessment criteria for construction noise, the noise levels found in Table 8-4 should not be exceeded.

Table 8-4
Detailed Assessment Criteria for Construction Noise

Land Use	8-Hour L_{eq} (dBA)		L_{dn} (dBA)
	Day	Night	30-day Average
Residential	80	70	75[(a)]
Commercial	85	85	80[(b)]
Industrial	90	90	85[(b)]

(a) In urban areas with very high ambient noise levels (L_{dn} > 65 dBA), L_{dn} from construction operations should not exceed existing ambient + 10 dBA

(b) Twenty-four-hour L_{eq}, not L_{dn}

Source: FRA 2005

For the purpose of this analysis of construction noise impacts, the FRA guidelines will be used, and distances to the 80 dBA and 70 dBA 8-hour L_{eq} noise contours will be calculated for heavy maintenance facility construction and the high speed train corridor construction phases. A majority of construction is anticipated to occur during daytime hours, but some nighttime construction may be necessary. In reference to Table 8-3, most local jurisdictions have construction noise exempt times where the FRA guidelines will take precedent, but outside of these construction noise exempt times, additional mitigation may be necessary in order to meet the local noise ordinances which can be found in Section 3.0 and summarized in Appendix B. Each local jurisdiction should be contacted before any construction activities commence.

8.3 Heavy Maintenance Facility and Train Station Construction

In order to assess the potential noise effects from construction of the heavy maintenance facility and train stations, this noise analysis used data from an extensive field study of various types of construction projects including public works projects (EPA 1971). Noise levels associated with various construction phases where all pertinent equipment is present and operating, at a reference distance of 50 feet, are shown in Table 8-1. Since a construction schedule and list of equipment have not been established for construction of the heavy maintenance facility and train stations, the construction phases and noise levels found in Table 8-1 are applied. The 1971 report gave a large range of noise levels associated with the various phases of construction activity (the standard deviation). Because technology improvements since the field study was published have resulted in consistently quieter vehicles and equipment, this analysis used the average noise levels shown in the table for the loudest construction phase. Using this assumption (an assumption confirmed by URS field measurements), the average overall noise level generated on a construction site could be 89 dBA at a distance of 50 feet during excavation and finishing phases. The noise levels presented are the energy average midpoint; the short-term magnitude of construction noise emission typically varies over time because construction activity is intermittent and the power demands on construction equipment (and the resulting noise output) are cyclical.

If a particular construction activity generated average noise levels of 89 dBA at 50 feet, the L_{eq} would be 83 dBA at 100 feet, 77 dBA at 200 feet, 71 dBA at 400 feet, and so on. This calculated reduction in noise level is based on the formula that calculates attenuation due to divergence. Intervening structures that block the line of sight, such as berms, hills or other manmade or natural landforms, would further decrease the resultant noise level by a minimum of 5 dBA. The effects of molecular air absorption and anomalous excess attenuation would reduce the noise level from construction activities at more distant locations at the rates of 0.7 dBA and 1.0 dBA per 1,000 feet, respectively.

The FRA recommended daytime and nighttime construction noise guidelines are found in Table 8-4. If construction is conducted during the local jurisdiction's construction noise exempt times, then the FRA guidelines take precedence. If construction is conducted outside of the local jurisdiction's construction noise exempt times, then additional mitigation may be necessary in order to avoid significant noise impacts in some areas. Per FRA construction noise guidelines, the daytime L_{eq} should not exceed an 8-hour L_{eq} of 80 dBA and the nighttime L_{eq} should not exceed an 8-hour L_{eq} of 70 dBA. Using the formula that calculates attenuation due to divergence, excavation and finishing activities would generate noise levels of 80 dBA L_{eq} at a distance of 140 feet, and 70 dBA L_{eq} at a distance of 450 feet. During the construction of the heavy maintenance facility and train stations, residences within a distance of 140 feet during daytime hours or 450 feet during nighttime hours may be impacted by noise levels that exceed the recommended FRA construction noise guidelines. Table 8-5 summarizes the noise impact contour distances for each construction phase for typical public works projects.

Table 8-5
Distances to FRA Noise Impact Contours from Construction Activities for the Heavy Maintenance Facility and Train Stations

Construction Activity	Average Sound Level* at 50 feet (dBA L_{eq})	Distance to 80 dBA L_{eq} FRA Noise Impact Contour (feet)	Distance to 70 dBA L_{eq} FRA Noise Impact Contour (feet)
Ground Clearing	84	80	255
Excavation	89	140	450
Foundations	78	39	130
Erection	87	115	355
Finishing	89	140	450

* Sound level with all pertinent equipment operating.

8.4 High-Speed Train Corridor Construction

There are seven distinct phases that make up the construction schedule for the high-speed train corridor. The seven construction phases are comprised of mobilization, site preparation, earth moving, construction of grade separations, construction of elevated track structures, track laydown, and demobilization. Each construction phase has a unique set of construction equipment that will be utilized. Appendix I provides a complete list of the construction equipment that will be used. Construction of grade separation and elevated track structures may consist of pile driving activities. In reference to Table 8-2, impact pile drivers generate an L_{max} of 101 dBA at a distance of 50 feet. Pile driving may be conducted during the construction of road crossings and elevated track structures.

The following equation calculates the resulting L_{eq} at a sensitive receiver for an individual piece of construction equipment. This formula will be used to estimate the 80 and 70 dBA L_{eq} noise contours for all construction activities as well as grade separation and elevated track structure construction activities with and without pile driving taking place.

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right) - 10G\log\left(\frac{D}{50}\right)$$

where: *L_{eq}(equip)* = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period

E.L. = noise emission level of the particular piece of equipment at a reference distance of 50 feet

G = constant that accounts for topography and ground effects

D = distance from the receiver to the piece of equipment, and

U.F. = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time

The following assumptions are adequate for a general assessment of each phase of construction:

- Noise source level: Full power operation for a time period of one hour is assumed because most construction equipment operates continuously for periods of one hour or more at some point in the construction period. Therefore, *U.F.* = 1, and 10 log(*U.F.*) = 0. The emission level at 50 feet, *E.L.*, is taken from Table 8-1. The predictions include only the two noisiest pieces of equipment expected to be used in each construction phase.

- Noise propagation: Free field conditions are assumed and ground effects are ignored. Consequently, *G* = 0. All pieces of equipment are assumed to operate at the center of the project, or centerline, in the case of a guideway or highway construction project.

Emission levels and usage factors for each piece of construction equipment were taken from the FHWA Road Construction Noise Model (RCNM) in order to calculate an L_{eq} for each construction activity. If the piece of equipment is not found in the RCNM, then the emission level and usage factor of similar equipment is used. The FRA recommended daytime and nighttime construction noise guidelines are found in Table 8-4. If construction is conducted during the local jurisdiction's construction noise exempt times, then the FRA guidelines take precedent. If construction is conducted outside of the local jurisdiction's construction noise exempt times, then additional mitigation may be necessary in order to avoid significant noise impacts in some areas. Per FRA construction noise guidelines, the daytime L_{eq} should not exceed an 8-hour L_{eq} of 80 dBA and the nighttime L_{eq} should not exceed an 8-hour L_{eq} of 70 dBA.

Two assumptions were made regarding construction equipment for every phase. First, all of the equipment will not be in operation simultaneously. Second, the equipment will be working within a 100 foot right-of-way and will likely be spread out along the entire work site. Due to these two conditions, it was estimated that only one-quarter of the amount of equipment that is listed for each construction phase would be heard in any one location adjacent to construction activities. Table 8-6 summarizes all of the construction activities and their respective distances to construction noise impact contours for daytime and nighttime work.

Table 8-6
Distances to FRA Noise Impact Contours from Construction Activities
for High-Speed Train Corridor

Construction Activity	Daytime 80 dBA L_{eq}	Nighttime 70 dBA L_{eq}
Mobilization	95	290
Site Preparation	150	460
Earthmoving	210	660
Grade Separation - Pile Driving	410	1,300
Grade Separation - No Pile Driving	180	575
Elevated Track Structures - Pile Driving	430	1,350
Elevated Track Structures - No Pile Driving	220	690
Lay Track	340	1,080
Demobilization	95	290

8.4.1 Mobilization

Mobilization construction activities are anticipated to begin in January 2013 and last through October 2013. This phase will be comprised mostly of flatbed trucks, dump trucks, backhoes, dozers, and an excavator. There will be 60 flatbed trucks, 5 dump trucks, 2 backhoes, 2 dozers and 1 excavator in operation per site.

Residences within a distance of 95 feet of mobilization construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 290 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.2 Site Preparation

Site preparation construction activities are anticipated to begin in April 2013 and last through August 2013. This phase will be comprised mostly of backhoes, dozers, excavators, loaders, scrapers and flatbed trucks. There will be 10 backhoes, 20 dozers, 10 excavators, 20 loaders, 2 scrapers and 30 flatbed trucks in operation per site.

Residences within a distance of 150 feet of site preparation construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 460 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.3 Earth Moving Construction Activities

Earth moving construction activities are anticipated to begin in August 2013 and last through August 2015. This phase will be comprised mostly of backhoes, bulldozers, excavators, loaders, graders, and scrapers. There will be 10 backhoes, 20 dozers, 8 excavators, 20 wheeled loaders, 10 graders, and 30 scrapers in operation per site.

Residences within a distance of 210 feet of earth moving construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 660 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.4 Grade Separation Construction Activities

Grade separation construction activities are anticipated to begin in October 2013 and last through April 2017. This phase includes a majority of the equipment that will also be used in earth moving construction activities except for the use of a pile driver. Some of the equipment that will be utilized during grade separation construction activities includes 20 air compressors, 2 roadway saws, 10 backhoes, 5 concrete saws, 4 bulldozers, 6 excavators, 8 wheeled loaders, 4 graders, 6 pile drivers, and 15 generators. Pile driving is expected to occur near the beginning of grade separation construction activities at each site. The resulting noise exposure levels are estimated for grade separation construction activities that take place with and without simultaneous pile driving activities. If construction is conducted during the local jurisdiction's construction noise exempt times, then the FRA guidelines take precedent. If construction is conducted outside of the local jurisdiction's construction noise exempt times, then additional mitigation may be necessary in order to avoid significant noise impacts in some areas.

With pile driving activities occurring simultaneously alongside the rest of the grade separation construction activities, residences within a distance of 410 feet of grade separation construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 1,300 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines. Without pile driving activities occurring simultaneously alongside the rest of the grade separation construction activities, residences within a distance of 180 feet of grade separation construction activities would be exposed to noise levels greater than 80 dBA L_{eq} and residences within a distance of 575 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.5 Elevated Track Structure Construction Activities

Elevated track structure construction activities are anticipated to begin in August 2013 and last through June 2017. This phase includes a majority of the equipment that will also be used in earth moving and grade separation construction activities. Similar to grade separation construction, pile driving activities are expected to occur during elevated track structure construction activities. Some of the equipment that will be utilized during elevated track structure construction activities includes 20 air compressors, 5 roadway saws, 10 backhoes, 10 concrete saws, 11 bulldozers, 12 excavators, 20 wheeled loaders, 4 graders, 6 pile drivers, and 15 generators. Pile driving is expected to occur near the beginning of construction activities at each site. The resulting noise exposure levels are estimated for elevated track structure construction activities that take place with and without simultaneous pile driving activities. If construction is conducted during the local jurisdiction’s construction noise exempt times, then the FRA guidelines take precedent. If construction is conducted outside of the local jurisdiction’s construction noise exempt times, then additional mitigation may be necessary in order to avoid significant noise impacts in some areas.

With pile driving activities occurring simultaneously alongside the rest of the elevated track structure construction activities, residences within a distance of 430 feet of elevated track structure construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 1,350 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines. Without pile driving activities occurring simultaneously alongside the rest of the elevated track structure construction activities, residences within a distance of 220 feet of elevated track structure construction activities would be exposed to noise levels greater than 80 dBA L_{eq} and residences within a distance of 690 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.6 Track Laying Construction Activities

Track laying construction activities are anticipated to begin in August 2015 and last through April 2018. This phase will be comprised mostly of ballast compactors, ballast cribbers, ballast regulators, tampers, portable rail drills, grinders and saws, tie removers/inserters, and track undercutters. There will be 5 ballast compactors, 5 ballast cribbers, 5 ballast regulators, 16 tampers, 20 portable rail drills, 20 portable rail grinders, 20 portable rail saws, 10 tie removers/inserters, and 6 track undercutters in operation per site.

Residences within a distance of 340 feet of track laying construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of

1,080 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.7 Demobilization

Demobilization construction activities are anticipated to begin in April 2018 and last through August 2018. This phase will be comprised mostly of flatbed trucks, dump trucks, backhoes, dozers, and an excavator. There will be 60 flatbed trucks, 5 dump trucks, 2 backhoes, 2 dozers and 1 excavator in operation per site.

Residences within a distance of 95 feet of demobilization construction activities would be exposed to noise levels greater than 80 dBA L_{eq} during daytime hours, and residences within a distance of 290 feet would be exposed to noise levels greater than 70 dBA L_{eq} during nighttime hours. Residences within these distances would be impacted by noise exposure levels that are greater than the recommended FRA threshold guidelines.

8.4.8 Mitigation of Construction Noise

All construction activities in this report were analyzed in terms of their noise impacts in regards to FRA recommended guidelines. Local jurisdictions provide construction noise exempt times where the FRA guidelines are followed. A majority of construction will be conducted during these construction noise exempt times, but when construction is conducted outside of the construction noise exempt times, construction noise must abide by local noise standards. Proper mitigation may be necessary in order to avoid noise impacts at nearby noise-sensitive receivers.

Pile driving activities conducted during the grade separation and elevated track structure construction phases would be the loudest noise generating activity during construction of the high speed train corridor. As previously mentioned, residences within a distance of 410 feet of grade separation construction activities that include pile driving, or within 430 feet of elevated track structure construction activities that include pile driving, would be exposed to noise levels greater than the 80 dBA L_{eq} threshold.

- Piles that are required for structure along the HST corridor and which would be located within 500 feet of a noise-sensitive receiver should be installed using the drilling and casing method.

If the drilling and casing method were used, maximum noise levels associated with construction activities would drop by 11 dB, and the distances to the 80 dBA L_{eq} contour would decrease from 410 feet to 180 feet for grade separation construction activities, and decrease from 430 feet to 220 feet for elevated track structure construction activities. Another method to mitigate noise related to pile driving is the use of an augur to install the piles instead of a pile driver which would reduce noise levels substantially. If pile driving is necessary, limit the time of day the activity can occur.

The most effective way to minimize the impact of construction noise during the development of the project is to enforce the time restrictions for the hours of construction as listed in local noise ordinances. It is important for the design engineer to plan the order of operations during construction so that the noise levels resulting from construction operations will not exceed local noise ordinances or those recommended by the FRA. To avoid unnecessary annoyance from construction noise, the following best practices for construction noise control should also be considered for inclusion in construction contract documents:

- All noise-producing project equipment and vehicles using internal combustion engines shall be equipped with mufflers and air-inlet silencers, where appropriate, in good operating condition that meet or exceed original factory specifications. Mobile or fixed "package" equipment (e.g., arc- welders, air compressors) shall be equipped with shrouds and noise control features that are readily available for that type of equipment.
- All mobile or fixed noise-producing equipment used on the project, which is regulated for noise output by a local, state, or federal agency, shall comply with such regulation while in the course of project activity.
- Material stockpiles and mobile equipment staging, parking, and maintenance areas shall be located as far as practicable from noise-sensitive receivers.
- Material stockpiles should be used to block line of site to nearby noise-sensitive receivers when possible.
- Locating fixed noise-generating equipment as far from noise-sensitive land uses as is practical.
- Limit the loudest construction activities, such as concrete breaking and jack hammering, to the middle of the day when the sensitivity to such noises will be minimal. Noise-producing signals, including horns, whistles, alarms, and bells shall be used for safety warning purposes only.
- No project-related public address or music system shall be audible at any adjacent receiver.
- If complaints arise, the contractor shall initiate a construction noise monitoring plan to ensure the construction noise levels at the nearest noise-sensitive land uses are within the limits of the noise ordinance.
- Avoid nighttime construction in residential neighborhoods.
- During nighttime work, use smart back-up alarms, which automatically adjust the alarm level based on the background level, or switch off back-up alarms and replace with spotters.
- Re-route construction-related truck traffic along roadways that will cause the least disturbance to residents.
- Implement noise-deadening measures for truck loading and operations.
- Minimize the use of generators to power equipment.
- Grade surface irregularities on construction sites.
- Use of temporary noise barriers shall be considered where project activities and equipment are unavoidably close to noise-sensitive receivers.
- Use of onsite trailers and containers as temporary barriers between any fixed construction noise source and nearby sensitive receivers.
- All workers involved with the construction of this project must be protected from excessive noise exposure as mandated by the Occupational Safety and Health Administration (OSHA), which has regulated worker noise exposure to a time-weighted-average of 90 dBA over an 8 hour work shift. Areas where levels exceed 85 dBA must be designated and labeled as high-noise-level areas where hearing protection is required.

8.5 Construction Vibration

During the construction of the proposed high-speed train project, some construction equipment has the potential to increase ground-borne vibration levels near sensitive receivers. For construction-related vibration, the FRA manual provides some vibration source levels for various pieces of construction equipment. These are listed in Table 8-7, and include the peak particle velocity (PPV) in inches per second, along with the corresponding velocity level (L_v) in VdB at a distance of 25 feet from the source. The type of equipment along with the sequence of construction operations have not been established for the project.

Table 8-7
Vibration Source Levels for Construction Equipment*

Equipment		PPV at 25 ft (in/sec)	Approximate L_v † at 25 ft
Pile Driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58
† RMS velocity in decibels (VdB) re 1 micro-inch/second			

*Source: Federal Transit Administration manual, Table 12-2, (FTA [1995] 2006).

8.5.1 Construction Vibration Criteria

It is highly unlikely that vibration from construction will damage any structures. Pile driving activities generate the highest levels of ground-borne vibration, but it is not very likely that pile driving will take place close to noise-sensitive receivers during construction. Vibration damage guidelines have been established by the FTA and these criteria are listed in Table 8-8.

Table 8-8
Construction Vibration Damage Criteria*

Building Category	PPV (in/sec)	Approximate L_v †
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90
† RMS velocity in decibels (VdB) re 1 micro-inch/second		

* Source: FTA assessment manual, Table 12-3 (FTA 2006).

The following equation is used to determine if there will be vibration impacts at sensitive receivers as the result of construction activities.

$$PPV_{equip} = PPV_{ref} \times \left(\frac{25}{D}\right)^{1.5}$$

where: PPV_{equip} = the peak particle velocity in in/sec of the equipment adjusted for distance,

PPV_{ref} = the reference vibration level in in/sec at 25 feet from Table 8-4, and

D = the distance, in feet, from the equipment to the receiver.

Vibration due to construction activities can also cause annoyance at sensitive receiver locations. The ground-borne vibration impact criteria for different land use categories can be found in Tables 3-26, 3-27, and 3-28, as well as in Figure 3-6. Annoyance caused by vibration from construction activities can possibly occur at sensitive receivers. Table 3-28 and Figure 3-6 illustrate the interpretation and perception of vibration at sensitive land uses. The following equation estimates the RMS vibration level (L_v) at any distance (D). The calculated level can then be compared to the criteria found in Tables 3-26 through 3-28 in order to see if there will be any cause for concern regarding vibration levels at sensitive receivers.

$$L_v(D) = L_v(25\,ft) - 30\log\left(\frac{D}{25}\right)$$

where: $L_v(D)$ = RMS vibration level at a given distance (in feet)

The distances to the peak and RMS damage threshold criteria for the construction equipment which generates the greatest levels of vibration were calculated, and the results are listed in Table 8-9. The results show that only the pile driving activities have the potential to damage buildings which are extremely susceptible to vibration damage.

Table 8-9
Distances to Construction Vibration Damage Criteria

Source	PPV at Receiver	L_v at Receiver	Distance From Centerline (feet)	Within right-of-way?	Impact
Pile Driver (impact) - Upper Range	0.121	90	135	No	Potential
Pile Driver (impact) - Typical	0.119	89	77	No	Potential
Pile Driver (sonic) - Upper Range	0.119	89	84	No	Potential
Pile Driver (sonic) - Typical	0.117	89	32	Yes	No
Vibratory Roller	0.117	89	37	Yes	No
Caisson Drilling	0.116	89	21	Yes	No
Large Bulldozer	0.116	89	21	Yes	No

8.5.2 Construction Vibration Mitigation

After locating potential vibration impacts due to construction with the use of the procedure outlined above, mitigation may be necessary to ensure that there will be no vibration impacts at sensitive receivers. Changes in the design and project layout, changes in the sequence of operations, and using alternative construction methods are all available vibration mitigation options.

When the engineers design the project and the layout of the project, heavily loaded trucks can be re-routed away from residential streets and onto streets with fewer homes. Earthmoving equipment on the construction lot should also be operated as far as possible from sensitive receivers. Changes in the sequence of operations can also mitigate vibration impacts at sensitive receivers. Construction activities that cause high levels of vibration should be staggered so that multiple sources of vibration are not occurring at once. Nighttime construction activities should also be avoided. Alternative construction methods are also an acceptable vibration mitigation option. If pile driving does occur, impact pile driving should be avoided near vibration-sensitive areas. A sonic or vibratory pile driver will generate lower vibration levels at sensitive receivers. Demolition methods not involving impacts should be used when possible. The utilization of vibratory rollers and packers should be avoided near vibration-sensitive receivers.

Section 9.0
Recommendations

9.0 Recommendations

It is recommended that this technical noise report be used to determine which project alternatives are best suited for this project. Once that determination has been made, and a single alignment has been selected and the engineering drawings are far enough along to be used for mitigation planning, then detailed noise and vibration mitigation measures should be developed and incorporated into the design drawings.

A noise insulation program should be developed and implemented for those noise-sensitive receivers that would be severely affected by the project but for which noise barriers would not be available due to mitigation feasibility and reasonableness parameters.

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Section 10.0
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10.0 References

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Section 11.0
Preparer Qualifications

11.0 Preparer Qualifications

The following individuals have made significant contributions to development of this technical report:

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Mr. Lindberg holds a B.A. degree in Mathematics from California State University, Long Beach and is a Board Certified Noise Control Engineer, with 20 years of experience in acoustics and noise control with a primary emphasis in surface and air transportation noise control and architectural acoustics, and serving as project manager, task manager, or technical team member for noise and vibration studies on dozens of projects throughout the United States. Mr. Lindberg's current professional focus areas include conducting noise analyses for environmental impact studies for railroad capacity improvement and grade separation projects, acoustical consulting on a refinery facility design project on the Alaskan North Slope, and noise analyses for the expansion of high school and college facilities.

William Vasquez, Contributing Author, Field Studies

Mr. Vasquez has over 4 years of experience working in environmental and transportation noise. He has a strong working knowledge of computers and is heavily involved in computer-aided noise modeling and field noise measurements for transportation and environmental noise projects. Transportation and Environmental Noise experience includes the evaluation of noise impacts on residential and commercial properties and traffic noise impacts on residential, industrial, and commercial receivers. Services in this area include onsite measurements, computer-aided noise modeling (including FHWA Traffic Noise Model version 2.5), evaluation of existing noise regulations and legislation, and evaluation of potential mitigation measures and options.

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Mr. McMullan is an acoustician and noise analyst with a B.A. in Acoustics from Columbia College of Chicago and background in environmental acoustics. He has 1.5 years of experience working in environmental and transportation noise. He has a strong working knowledge of computers and is heavily involved in computer-aided noise modeling and field noise measurements for transportation and environmental noise projects. Transportation and Environmental Noise experience includes the evaluation of noise impacts from traffic, power plants, and wind farms on residential, industrial, and commercial receivers. Services in this area include onsite measurements, computer-aided noise modeling (including CadnaA), evaluation of existing noise regulations and legislation, and evaluation of potential mitigation measures and options.

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Mr. Reeves has a B.S. degree in Information Systems from Western Carolina University, and has over nineteen years of combined transportation and industrial noise control experience. Included in this experience are numerous airport, power generation facility, and transportation-related community noise exposure studies including the development of noise exposure contours utilizing the Federal Aviation Administration's Integrated Noise Model, the U.S. Air Force's NOISEMAP aircraft noise modeling software, Federal Highway Administration's Traffic Noise Model and CADNA/A® modeling software. Mr. Reeves has managed all facets of these studies including the design and conduct of noise measurement surveys, operational data analysis, spatial data analysis, aircraft ground maintenance run-up analysis, airspace implications on community noise exposure, design of aircraft noise mitigation measures and computer model validation with a particular interest in aircraft performance and operational procedures. Mr. Reeves is a member of the Federal Aviation Administration's Design Review Group, responsible for providing input and beta testing for updates to the Integrated Noise Model and the soon-to-be-released Aviation Environmental Design Tool.

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James P. Cowan holds an M.S. degree in Acoustics from Pennsylvania State University and is a board-certified noise control engineer with over 28 years of experience in noise control, architectural acoustics, and environmental noise issues. He has managed hundreds of acoustical projects nationwide, including writing educational programs and policies for public agencies and more than 100 Environmental Impact Statement noise chapters for all types of projects. He has consulted to public agencies, architects, engineers, industrial personnel, and attorneys in all areas of indoor and outdoor noise control; hearing damage and protection criteria; and acoustic design of offices, studios, dwellings, worship spaces, schools, and theaters.

Appendices

Appendix A

Fundamental Concepts of Noise and Vibration for High-Speed Trains

The purpose of this appendix is to provide the reader with some fundamental background information on the concepts of noise and vibration generated from high-speed train systems. This appendix is adapted from Chapter 2 (Noise) and Chapter 6 (Vibration) of the FRA *High-Speed Ground Transportation Noise and Vibration Impact Assessment* manual (FRA 2005) as it relates to this project.

The discussion here focuses on noise generation, propagation, and mitigation for steel-wheel high-speed train systems. For information on noise and vibration descriptors, noise and vibration impact criteria, and noise and vibration prediction methodology, see Sections 3.0, 4.0, and 6.0 of the main body of this report, respectively.

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Appendix A1
Basics of Noise for High-Speed Trains

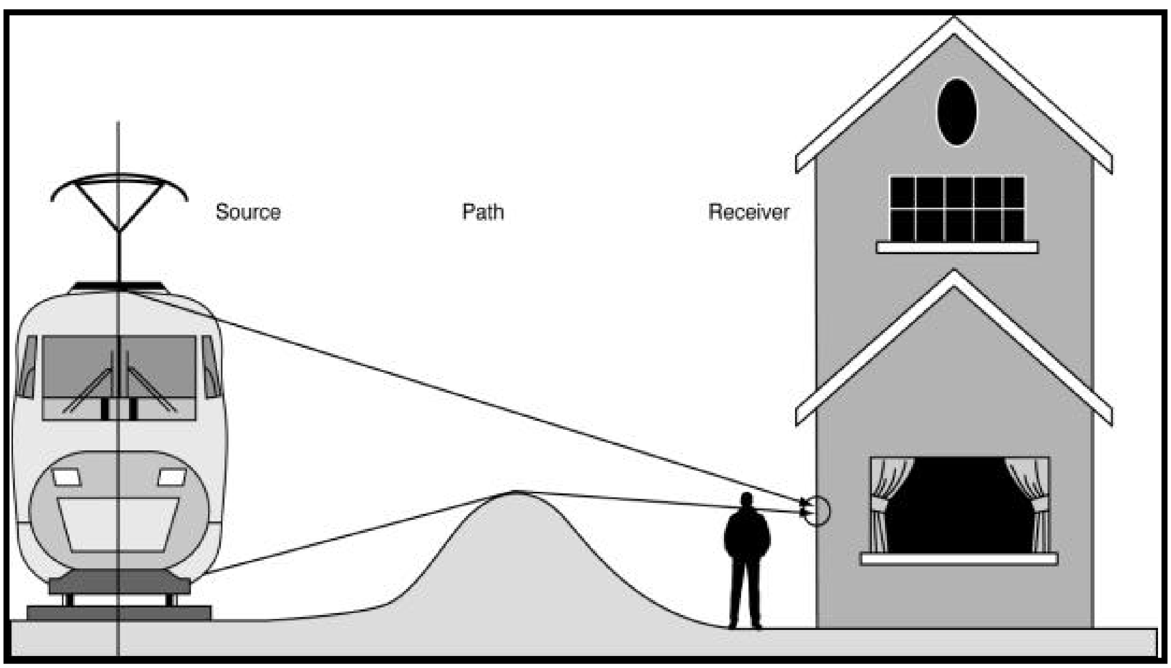
A1 Introduction

Noise from high-speed train systems is similar to noise from other rail systems except for a few unique features resulting from the higher speeds of travel. The rail systems defined as "high-speed" are primarily steel wheeled, both electrically powered and fossil fueled, capable of maximum speeds of 125 mph and greater. Noise characteristics of these trains vary considerably as speed increases.

Consequently, this appendix sub-divides these systems into two categories:

- "High-speed," with a maximum speed of 150 mph.
- "Very high-speed," with a maximum speed of 250 mph.

Because ancillary sources are not unique to high speed train systems, noise from electrical substations, maintenance facilities, yards, and stations, are not addressed in this appendix. These noise sources are substantially the same for any type of rail system and do not have characteristics specific to high-speed train systems. The methods described in the corresponding transit noise manual from the Federal Transit Administration are applicable. This section discusses the basic concepts of high-speed ground transportation noise to provide background for the assessment procedures discussed in Section 7. Noise from a ground transportation system is often expressed in terms of a Source-Path-Receiver framework. This framework is sketched on Figure A-1 and is central to all environmental noise studies. Each project **source** generates close-by noise levels, which depend on the type of source and its operating characteristics. Then, along the propagation **path** between all sources and receivers, noise levels are reduced (attenuated) by distance, intervening obstacles, and other factors. Finally, at each **receiver**, noise combines from all sources and may interfere with receiver activities.



Source: FRA 2005

Figure A-1
The source-path-receiver framework

This appendix emphasizes the **sources** of noise from high-speed trains and, to a lesser extent, the **path** component, which includes aspects such as sound attenuation with increasing distance from the source, excess attenuation due to atmospheric absorption and ground effects, and acoustic shielding by terrain, sound barriers, or intervening buildings.

In brief, this appendix contains an overview of noise **sources**, including a list of major sources specific to high-speed train systems and discussion of noise-generation mechanisms and an overview of noise **paths**, with a discussion of the various attenuating mechanisms in the path between source and receiver.

A1.1.1 Sources of High Speed Train Noise

The total wayside noise generated by a high-speed train pass-by consists of several individual noise generating mechanisms, each with its own characteristics of source location, strength, frequency content, directivity, and speed dependence. These noise sources can be generalized into three major regimes:

Regime I. propulsion or machinery noise.

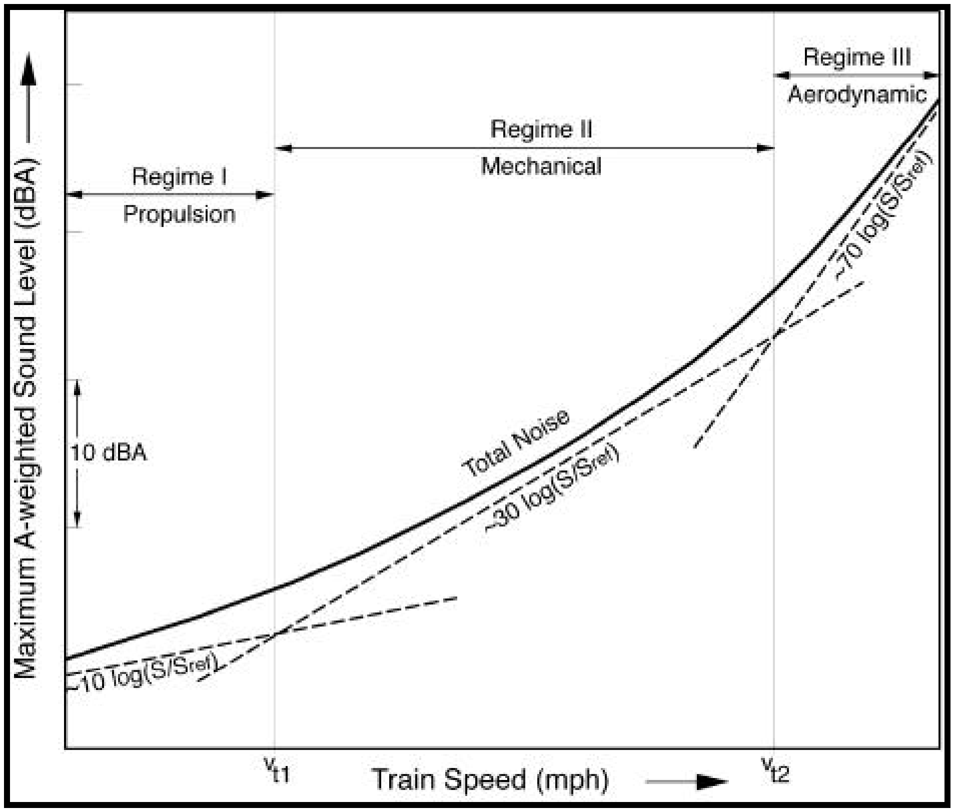
Regime II. mechanical noise resulting from wheel/rail interactions and/or guideway vibrations.

Regime III. aerodynamic noise resulting from airflow moving past the train.

For a conventional train with a maximum speed of up to about 125 mph, propulsion and mechanical noise are sufficient to describe the total wayside noise. The aerodynamic noise component begins to be an important factor when the train speed exceeds about 160 mph.

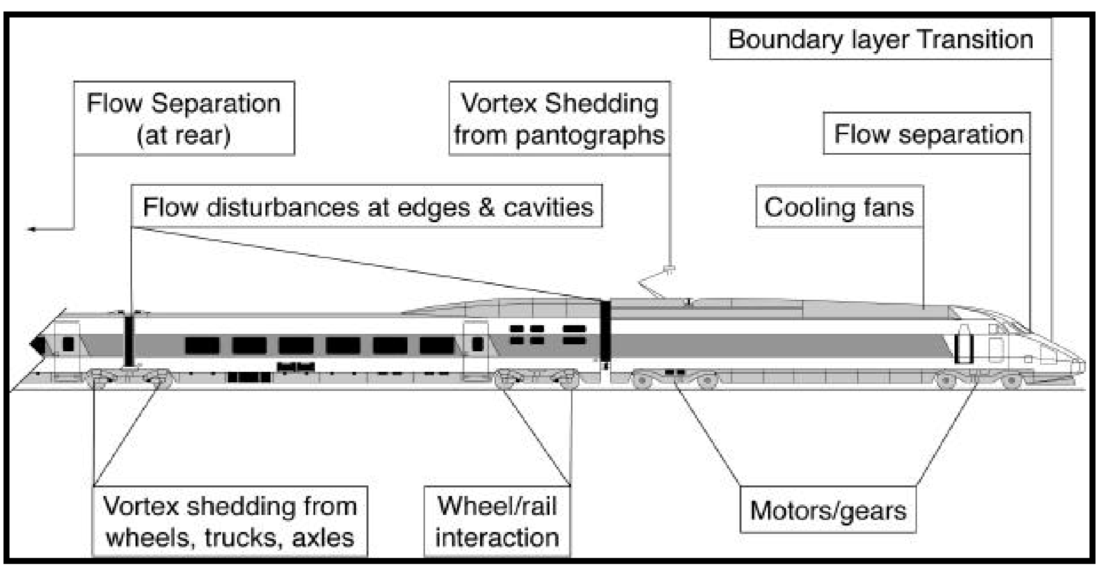
The significance of these different regimes is that, for a given train, there are three distinct speed ranges in which only one sound source dominates the total noise level. The dependence of the A-weighted sound level on vehicle speed (S) for a typical high-speed train is illustrated on Figure A-2. A qualitative indication of the maximum sound level during a pass-by is plotted vertically in this figure. The three speed regimes are labeled "I," "II," and "III," each corresponding to the dominant sound source in the regime, or propulsion, mechanical, and aerodynamic noise, respectively. The speed at which the dominant sound source changes from one to another is called an acoustical transition speed (vt). The transition from propulsion noise to mechanical noise occurs at the lower acoustical transition speed (vt1), and the transition from mechanical to aerodynamic noise occurs at the upper acoustical transition speed (vt2).

The various noise sources for a steel-wheeled high-speed tracked system are illustrated on Figure A-3. These sources differ in where they originate on the train and in what frequency range they dominate.



Source: FRA 2005

Figure A-2
Generalized sound dependence on speed



Source: FRA 2005

Figure A-3
Noise sources on a steel-wheeled high-speed train system

A. REGIME I: PROPULSION SOURCES

For steel wheeled trains at low speeds, Regime I, propulsion mechanisms, or machinery and auxiliary equipment that provide power to the train are the predominant sound sources. Most high-speed trains are electrically powered; the propulsion noise sources are, depending on the technology, associated with electric traction motors or electromagnets, control units, and associated cooling fans (see Figure A-3). Fans can be a major source of noise; on conventional steel-wheeled trains fans are usually located near the top of the power units, about 10 feet above the rails. Fan noise tends to dominate the noise spectrum in the frequency bands near 1000 Hz. External cooling fan noise tends to be constant with respect to train speed, which makes fans the dominant noise when a train is stopped in a station.

B. REGIME II: MECHANICAL/STRUCTURAL SOURCES

The effects of wheel-rail interaction of high-speed trains, guideway structural vibrations, and vehicle -body vibrations fall into the category of mechanical noise sources. These sources tend to dominate the total noise level at intermediate speeds (Regime II), and cover the widest of the three speed regimes. For steel-wheeled trains, wheel-rail interaction is the source of the rolling noise radiated by steel wheels and rails caused by small roughness elements in the running surfaces. This noise source is close to the trackbed, with an effective height of about 2 feet above the rails. The spectrum for rolling noise peaks in the 2 kHz to 4 kHz frequency range, and it increases more rapidly with speed than does propulsion noise, typically following the relationship of 30 times the logarithm of train speed. Wheel-rail noise typically dominates the A-weighted sound level at speeds up to about 160 mph.

C. REGIME III: AERODYNAMIC SOURCES

Propulsion and rolling noise are generally sufficient to describe the total noise up to speeds of about 160 mph for steel-wheeled trains. Above this speed, however, aerodynamic noise sources tend to dominate the radiated noise levels. These sources begin to generate significant noise at speeds of about 180 mph, depending on the magnitude of the mechanical/structural noise. For steel-wheeled trains, aerodynamic noise is generated from high-velocity airflow over the train. The components of aerodynamic noise are generated by unsteady flow separations at the front and rear of the train and on structural elements of the train (mainly in the regions encompassing the trucks, the pantograph, inter-coach gaps, and discontinuities along the surface), and a turbulent boundary layer generated over the entire surface of the train. Aerodynamic sources generally radiate sound in the frequency bands below 500 Hz, generally described as a rumbling sound. Aerodynamic noise level increases with train speed much more rapidly than does propulsion or rolling noise, with typical governing relationships of 60 to 70 times the logarithm of speed.

A1.1.2 Sound Propagation Path

This section contains a qualitative overview of noise-path characteristics from source to receiver, including attenuation along these paths. Sound paths from source to receiver are predominantly airborne. Along these paths, sound reduces with distance due to (1) **divergence**, (2) **absorption/diffusion**, and (3) **shielding**. The general equation for the prediction of the A-weighted sound level at various distances from the track can be expressed as follows:

$$LA = LA(ref) + Cd + Ca + Cg + Cb$$

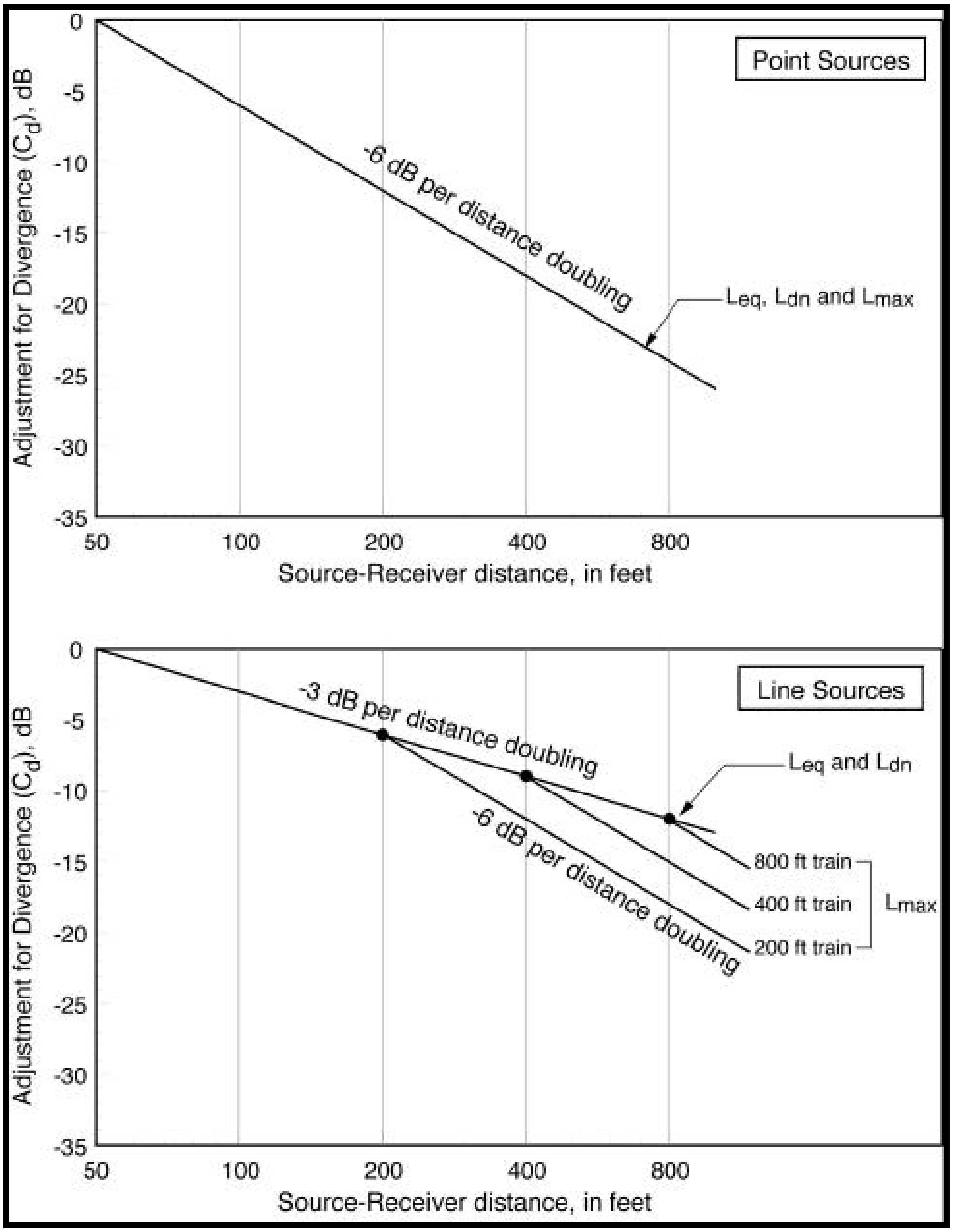
where:

> *LA(ref)* = a known A-weighted sound level at some reference distance *ref* from the source
>
> *Cd* = adjustment factor for attenuation due to divergence
>
> *Ca* = adjustment factor for excess attenuation due to atmospheric absorption
>
> *Cg* = adjustment factor for excess attenuation from ground absorption
>
> *Cb* = adjustment factor for excess attenuation due to obstacles such as barriers, berms, and buildings.

In nearly all cases, the adjustment factors are negative numbers due to the nature of the reference conditions. Each of these adjustment factors is discussed below in terms of their mechanisms of sound attenuation. Specific equations for computing noise-level attenuations along source-receiver paths are presented in the FRA guidelines document (FRA 2005). Sometimes a portion of the source-to-receiver path is not through the air, but rather through the ground or through structural components of the receiver's building. Ground-borne and structure-borne noise propagation are discussed in section A2 of this appendix.

A. DIVERGENCE

Sound levels naturally attenuate with distance. Such attenuation, technically called "divergence," depends upon source configuration and source-emission characteristics. Divergence is shown graphically for point sources and line sources separately in terms of how they attenuate with distance on Figure A-4. The divergence adjustment factor, *Cd*, for the receiver is plotted vertically relative to the sound level 50 feet from the source. As shown, the sound level attenuates with increasing distance due to the geometric spreading of sound energy. For sources grouped closely together (called point sources), attenuation with distance is large: 6 decibels per doubling of distance. Most individual noise sources on a moving high-speed rail vehicle radiate sound as point sources. When many point sources are arrayed in a line, all radiating sound at the same time so any one source is not distinguishable, the arrangement is called a line source. For line sources, divergence with distance is less: 3 decibels per doubling of distance for L_{eq} and L_{dn}, and 3 to 6 decibels per doubling of distance for L_{max}. A train passing along a track or guideway can be considered a line source. In Figure A-4, the line source curve separates into three separate lines for L_{max}, with the point of departure depending on the length of the line source. For example, close to a short train, it behaves like a line source; far away, it behaves as a point source. The curves shown on Figure A-4 are for illustrative purposes only, and the exact equations for these curves given in the FRA Guideline Document are be used for quantitative analyses.



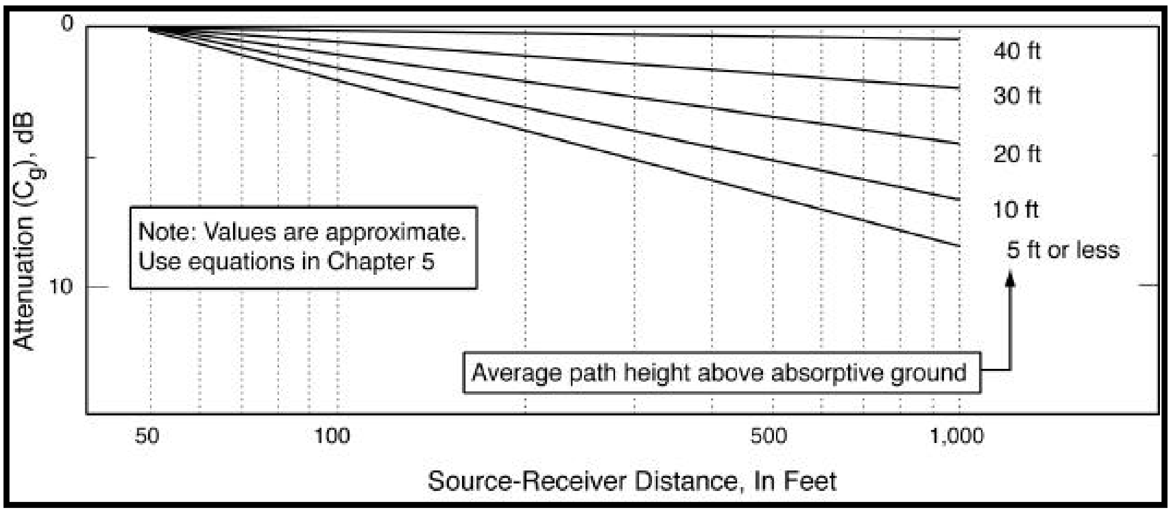
Source: FRA 2005

Figure A-4
Attenuation due to distance

Some sound sources, such as warning bells, radiate sound energy nearly uniformly in all directions. These are called nondirectional, or monopole, sources. For train noise, however, the rolling noise from wheel-rail interactions, as well as some types of aerodynamic noise, is complicated because the sources do not radiate sound equally well in all directions. This unequal radiation is known as source directivity, which is a measure of the variation in a source's radiation with direction. Studies have shown that wheel-rail noise can be modeled by representing the source as a line source (or continuous row of point sources) with dipole directivity. A dipole radiation pattern has also been observed in the turbulent boundary layer near the sides of a train. Typically, a dipole source radiates a directivity pattern such that the sound pressure is proportional to the cosine of the angle between the source orientation and the receiver. Consequently, wheel-rail noise is propagated more efficiently to either side of a moving train than in front, above or behind it.

B. ABSORPTION/DIFFUSION

In addition to the attenuation from geometric spreading of the sound energy, sound levels are further attenuated when sound paths lie close to absorptive or "soft" ground, such as freshly plowed or vegetation-covered areas. This additional attenuation, which can be 5 decibels or more within a few hundred feet, is illustrated graphically on Figure A-5. In this figure the adjustment factor, *Cg*, is plotted vertically as a function of distance. At very large distances, wind and temperature gradients can alter the ground attenuation shown here; such variable atmospheric effects generally influence noise levels well beyond the range of typical railway noise impact and are not included in this manual. Equations for the curves on Figure A-5 are presented in Chapter 5 of the FRA Guidelines manual.

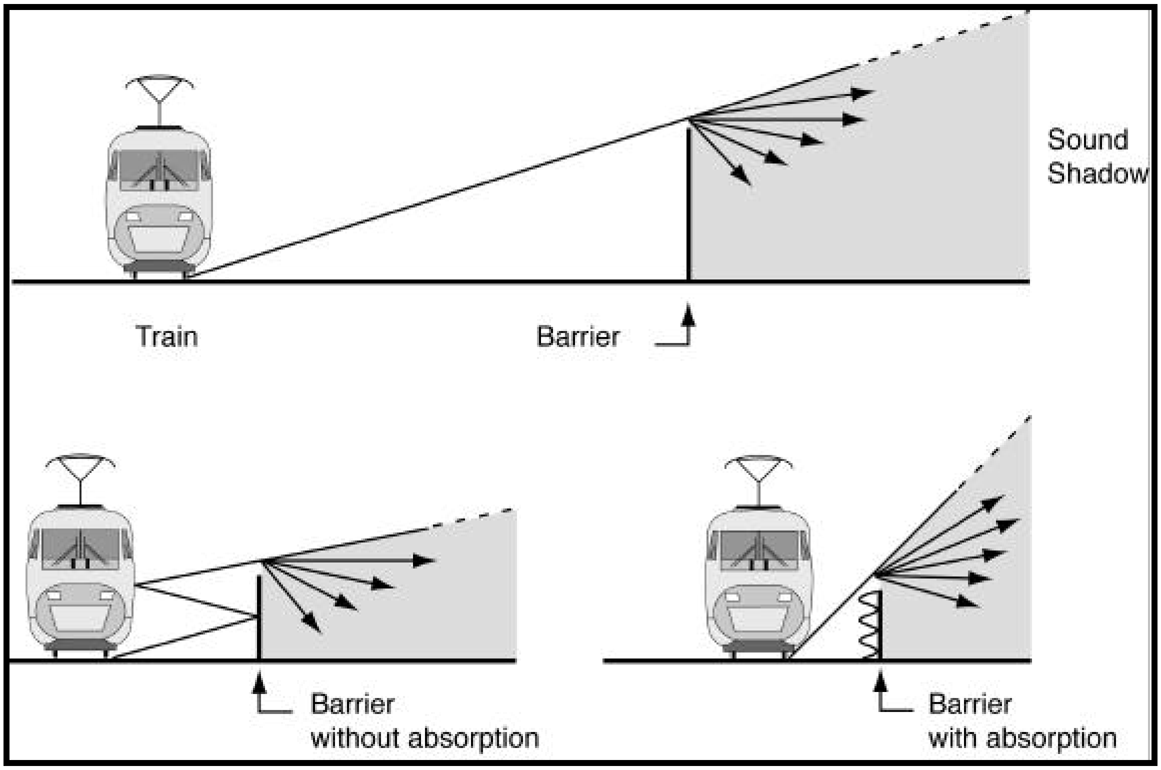


Source: FRA 2005

Figure A-5
Sound attenuation due to soft ground

C. SHIELDING

Sound paths are sometimes interrupted by noise barriers, by terrain, by rows of buildings, or by vegetation. Noise barriers, usually the most effective means of mitigating noise in sensitive areas, are the most important of these path interruptions. A noise barrier reduces sound levels at a receiver by breaking the direct path between source and receiver with a solid wall; vegetation, in contrast, hides the source but does not reduce sound levels significantly. Sound energy reaches the receiver only by bending (diffracting) over the top of the barrier, as shown on Figure A-6. This diffraction reduces the sound level at the receiver.



Source: FRA 2005

Figure A-6
Noise barrier geometry

Noise barriers for transportation systems typically attenuate noise at the receiver by 5 to 15 dBA (which corresponds to an adjustment factor *Cb* range of -5 to -15 dBA), depending upon receiver and source height, barrier height, length, and distance from both source and receiver. The attenuation of noise by a barrier also is frequency dependent, i.e., all other factors being the same, the higher the frequency of the noise, the greater the barrier attenuation. As discussed in the section on train noise sources, the peak frequencies and source heights of high-speed ground transportation noise vary according to the dominant noise source in a particular speed regime. In general, aerodynamic noise has lower peak frequencies than does wheel-rail noise, which means that a barrier is less effective at attenuating aerodynamic noise. In addition, aerodynamic noise sources tend to be located higher up on the train than wheel-rail noise sources. As a result, a noise barrier high enough to shield aerodynamic noise will be relatively expensive compared to a barrier for controlling wheel-rail noise, since it must extend 15 feet or more above the top of rail. For operating speeds up to about 160 mph, a barrier high enough to shield wheel-rail and other lower car body sound sources would normally provide sufficient sound attenuation.

Barriers on structure, very close to the source, provide less attenuation than predicted using standard barrier attenuation formulae, due to reverberation (multiple reflections) between the barrier and the body of the train. This reverberation can be offset by increased barrier height, which is easy to obtain for such close barriers, and/or the use of acoustically absorptive material on the source side of the barrier. These concepts are illustrated on Figure A-6. Acoustical absorption is considered as a mitigation option in detailed noise analysis. Equations for barrier attenuation and equations for other sound-path interruptions are also presented in the Detailed Noise Analysis section of the FRA Guidelines document (FRA 2005).

Appendix A2
Basics of Vibration for High-Speed Trains

A2 Basics of Vibration for High Speed Trains

Noise and vibration are traditionally linked in environmental impact assessments because the two disciplines are perceived to have many physical characteristics in common. For example, noise can be generated by vibration of surfaces. Both involve fluctuating motion: noise is oscillating motion of air and vibration is oscillating motion of structures or the ground. Both are analyzed as wave phenomena: noise is made up of sound waves in air and vibration travels as waves in the ground. Both can be measured in decibels. Both are considered sensory effects: noise is related to hearing and vibration is related to feeling. Despite their similarities, however, noise and vibration require entirely different kinds of analyses. The fact that ground-borne vibration travels through a succession of solid media, such as various kinds of soil, rock, building foundation, and building structure, to reach the receiver makes vibration more complicated to measure and to predict than noise.

This section provides a general background on ground-borne vibration and summarizes the available data on ground-borne vibration caused by high-speed trains. The material presented is based largely on empirical data, since ground-borne vibration is a more complex phenomenon than that of airborne noise.

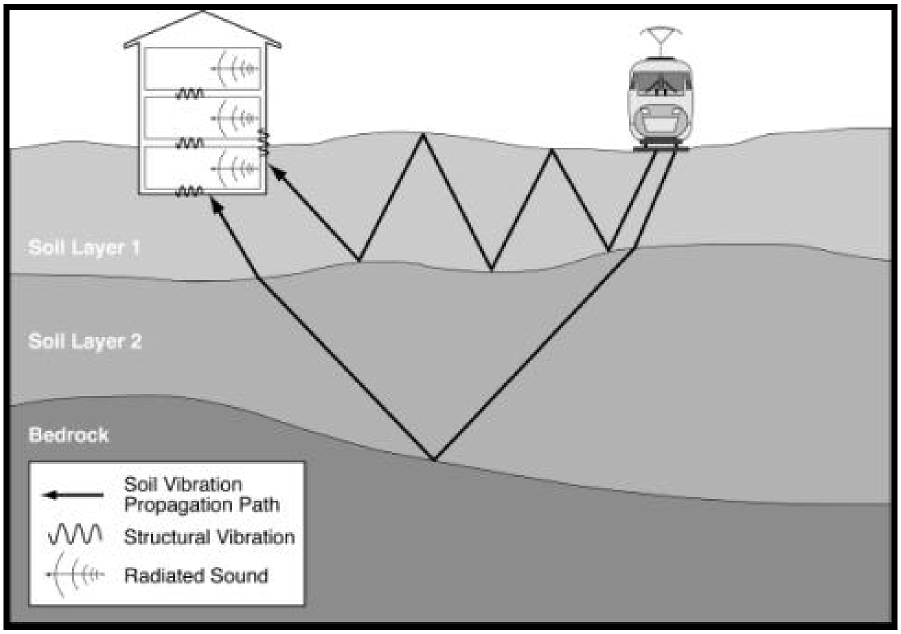
The effects of ground-borne vibration include perceptible movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, such vibration can damage buildings and other structures. Building damage is not a factor for most surface transportation projects, except during construction when there may be occasional blasting and pile driving. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 5 to 10 decibels. This vibration level is an order of magnitude below the damage threshold for normal buildings.

The basic concepts of ground-borne vibration are illustrated for a high-speed train system on Figure A-7. The train wheels rolling on the rails create vibration energy transmitted through the track support system into the trackbed or track structure. The amount of energy that is transmitted into the track structure depends strongly on factors such as how smooth the wheels and rails are and the resonance frequencies of the vehicle suspension system and the track support system.

The vibration of the track or guideway structure excites the adjacent ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. The vibration propagates from the foundation throughout the remainder of the building structure. The maximum vibration amplitudes of floors and walls of a building often occur at the resonance frequencies of those building elements.

The vibration of floors and walls may cause perceptible vibration, rattling of items such as windows or dishes on shelves, or a rumble noise. The rumble is the noise radiated from the motion of the room surfaces. In essence, the room surfaces act like a giant loudspeaker. This is called ground-borne noise.

Ground-borne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, the motion does not provoke the same adverse human reaction without the effects associated with the shaking of a building. In addition, the rumble noise that usually accompanies the building vibration can only occur inside buildings.



Source: FRA 2005

Figure A-7
Propagation of ground-borne vibrations into buildings

A2.1 Human Perception of Ground-Borne Vibration and Noise

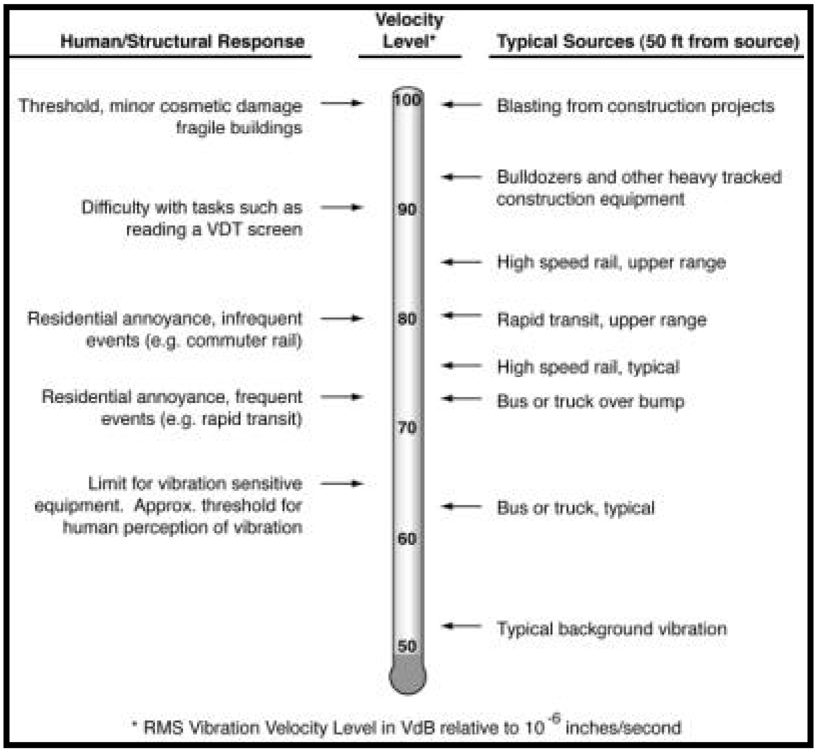
This section gives some general background on human response to different levels of building vibration, thereby establishing the basis for the criteria for ground-borne vibration and noise that are presented in Section 4.2 of this report.

A2.1.1 Typical Levels of Ground-Borne Vibration and Noise

In contrast to airborne noise, ground-borne vibration is not a phenomenon that most people experience every day. The background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans, which is around 65 VdB. Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible.

Common vibration sources and the human and structural response to ground-borne vibration are illustrated on Figure A-8. The range of interest is from approximately 50 VdB to 100 VdB. Background vibration is usually well below the threshold of human perception and is of concern only when the vibration affects very sensitive manufacturing or research equipment, such as electron microscopes and high resolution photo lithography equipment.

The relationship between ground-borne vibration and ground-borne noise depends on the frequency content of the vibration and the acoustical absorption of the receiving room. The more acoustical absorption in a room, the lower the noise level will be. For a room with average acoustical absorption, the sound pressure level is approximately equal to the average vibration velocity level of the room surfaces. Hence, the A-weighted level of ground-borne noise can be estimated by applying A-weighting to the vibration velocity spectrum. Since the A-weighting at 31.5 Hz is -39.4 dB, if the vibration spectrum peaks at 30 Hz, the A-weighted sound level will be approximately 40 decibels lower than the velocity level. Correspondingly, if the vibration spectrum peaks at 60 Hz, the A-weighted sound level will be about 25 decibels lower than the velocity level.



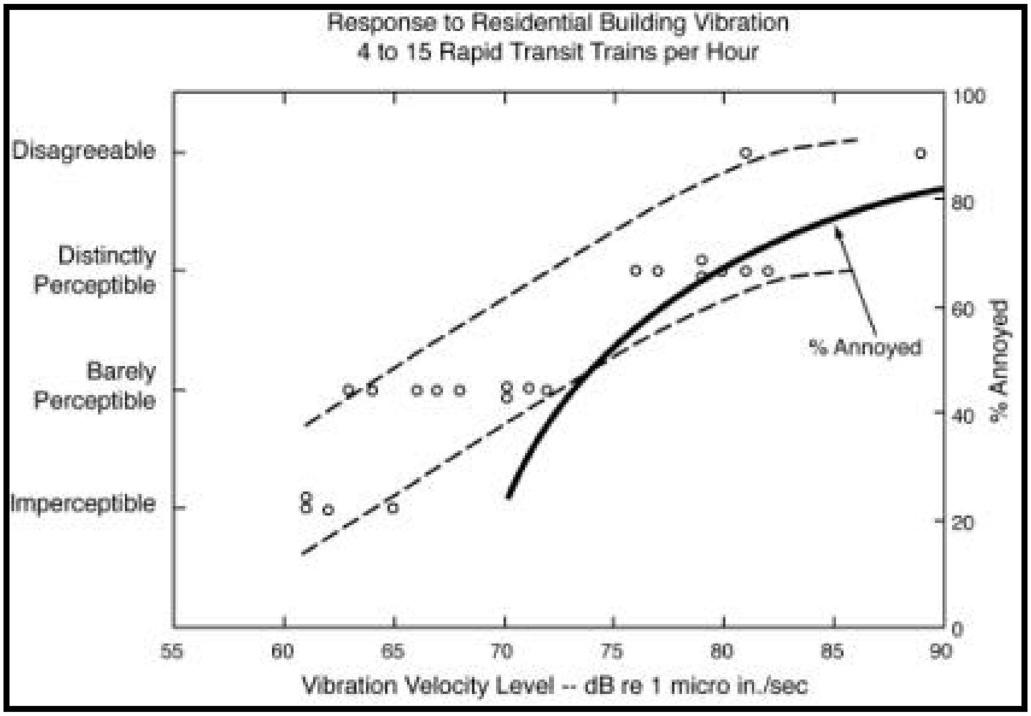
Source: FRA 2005

Figure A-8
Typical levels of ground-borne vibration

A2.1.2 Quantifying Human Response to Ground-Borne Vibration and Noise

One of the major problems in developing suitable criteria for ground-borne vibration is that there has been relatively little research into human response to vibration, in particular, human annoyance with building vibration. However, experience with U.S. rapid transit projects over the past 20 years represents a good foundation for developing suitable limits for residential exposure to ground-borne vibration and noise from high-speed rail operations.

The relationship between the vibration velocity level measured in 22 homes and the general response of the occupants to vibration from rapid transit trains is illustrated on Figure A-9. The data points shown were assembled from measurements that had been performed for several transit systems. The subjective ratings are based on the opinion of the person who took the measurements and the response of the occupants. Both the occupants and the people who performed the measurements agreed that floor vibration in the "Distinctly Perceptible" category was unacceptable for a residence. The data shown on Figure A-9 indicate that residential vibration exceeding 75 VdB is unacceptable if trains are passing every 5 to 15 minutes, as is usually the case with urban transit trains. Additional social survey data are provided by a Japanese study on vibration pollution conducted in 1975. The percent of people annoyed by vibration from high-speed trains in Japan is shown by the "% annoyed" curve on Figure A-9. Note that the scale corresponding to the percent annoyed is on the right hand axis of the graph. The results of the Japanese study confirm the conclusion that at vibration velocity levels ranging from 75 to 80 VdB, many people will find the vibration annoying.



Source: FRA 2005

Figure A-9
Occupant response to urban transit-induced residential vibration

A2.2 Factors That Influence Ground-Borne Vibration and Noise

Developing accurate estimates of ground-borne vibration is complicated by the many factors that can influence vibration levels at the receiver position. Factors that have significant effects on the levels of ground-borne vibration are discussed in this section. Some of these factors that are known to have, or are suspected of having, a significant influence on the levels of ground-borne vibration and noise are reviewed in this section. The physical parameters of the track, and trainsets, geology, and receiving building can all influence vibration levels. The important physical parameters can be divided into the following four categories:

Operational and Vehicle Factors: This category includes all of the parameters that relate to train vehicles and the operation of trains. Factors such as high speed, stiff primary suspensions on the vehicle, and flat or worn wheels will increase the possibility of ground-borne vibration problems.

Guideway: The type and condition of the rails, the type of guideway, the rail support system, and the mass and stiffness of the guideway structure can all influence the level of ground-borne vibration. Worn rail and wheel impacts at special trackwork can substantially increase ground-borne vibration. A high-speed train system guideway will be either in tunnel, open trench, at-grade, or aerial guideway. It is rare for ground-borne vibration to be a problem with aerial structures, except when guideway supports are located within 50 feet of buildings. Directly radiated airborne noise is usually the dominant problem from guideways at-grade or in cut, although vibration can sometimes be a problem. For tunnels that are under residential areas, however, ground-borne noise and vibration are often among the most significant environmental problems.

Geology: Soil conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock. Experience has shown that vibration propagation is more efficient in clay soils as well as areas with shallow bedrock; the latter condition seems to channel or concentrate the vibration energy close to the surface, resulting in ground-borne vibration problems at large distances from the track. Factors such as layering of the soil and depth to water table can also have significant effects on the propagation of ground-borne vibration.

Receiving Building: Ground-borne vibration problems occur almost exclusively inside buildings. Therefore, the characteristics of the receiving building are a key component in the evaluation of ground-borne vibration. The train vibration may be perceptible to people who are outdoors, but it is very rare for outdoor vibration to cause complaints. The vibration levels inside a building depend on the vibration energy that reaches the building foundation, the coupling of the building foundation to the soil, and the propagation of the vibration through the building structure. The general guideline is that the more massive a building is, the lower its response to incident vibration energy in the ground.

A2.3 Ground-Borne Vibration from High-Speed Trains

Available data on ground-borne vibration from high-speed trains are from measurements of test programs involving the Acela in the United States and the TransRapid TR08 in Germany, and revenue service operations of the X2000 in Sweden, the Pendolino in Italy, and the Trains à Grande Vitesse (TGV) and Eurostar trains in France. Acela and TR08 tests were performed in 2000-2001. The European revenue service data were obtained in May 1995 as part of the data collection task involved in preparing the FRA guidelines (FRA 2005). Vibration measurements were made at two sites in each country, with vibration propagation testing done at one primary site in each country. This measurement program represents one of the first times that the same detailed ground-borne vibration testing procedure has been carried out in several different countries for high-speed trains operating under normal revenue conditions.

One of the major problems in characterizing ground-borne vibration from trains is that geology has a major influence in vibration levels, and there are no analytical methods of factoring out the effects of geology. This makes it very difficult to compare the levels of ground-borne vibration from different types of trains, unless they are operating on the same track. An experimental method of characterizing vibration propagation characteristics at a specific site that was developed to work around this problem was applied during the tests in Sweden, Italy, and France.

This propagation test procedure basically consists of dropping a weight on the ground and measuring the force of the impact and the vibration pulses at various distances from the impact point. The transfer functions between the vibration pulses and the force impulse are then used to characterize vibration propagation. Assuming a reasonably linear system, these transfer functions define the relationship between any type of exciting force and the resulting ground vibration.

The end result of the propagation test is a measure of the transmissibility of ground vibration, or line source transfer mobility, as a function of distance from the train. Measurements of train vibration and line source transfer mobility at the same site can be used to derive a "force density" function that characterizes the vibration forces of a train independent of the geologic conditions at the site. The test is discussed in greater detail in the Detailed Vibration Assessment section of the FRA Guidelines document (FRA 2005). The steps used to analyze the train vibration and ground transfer mobility data to derive force densities were as follows:

1. Transfer mobility and train vibration were expressed in terms of frequency-dependent representations, or frequency spectra.
2. Raw transfer mobility data for *point sources* were combined to approximate *line source* transfer mobility at each test site.
3. Best-fit curves of level vs. distance for each frequency band were obtained using linear regression or other curve-fitting techniques, approximate line-source transfer mobility, and train vibration spectra as a function of distance from the source.

The difference between the train vibration spectrum and the transfer mobility spectrum at the same distance, or the *force density* spectrum, was calculated. Theoretically the force density should be independent of distance. In practice, however, force density is calculated at each measurement distance, and the average force density is used to characterize each type of trainset. For all of the trainsets, the force densities at the six measurement distances converged to within 3 to 4 decibels of the average.

Appendix B
Local Regulations

At the local level, alternative HST alignments cross several county and municipal jurisdictions that overlay from Fresno to Bakersfield. Many of these jurisdictions have ordinances regarding noise. Table B-1 presents a summary of the significant local noise criteria for each of these jurisdictions.

The cities and counties also have general plans, in which ambient noise levels have been measured and/or predicted, often as a part of a distinct "noise element" of the planning documentation. This information is used to assess potential incompatibilities with respect to land use and support development or refinement of noise ordinances.

In many cases, these general plan noise elements (or similarly prepared EIRs) illustrate existing community noise levels as contours presented in terms of the CNEL or L_{dn}. CNEL values are typically within 1 decibel of the L_{dn}, which is used to evaluate rail noise in residential land uses.

In addition to the criteria presented in Table B-1, and to cover noise sources not specifically addressed in other code portions, local noise ordinances for many of the jurisdictions crossed by HST alternative alignments tend to feature a section that usually lists several sample criteria that the jurisdiction may use to determine a noise violation. These standards are or usually resemble the following:

- The sound pressure level of the noise.
- The octave band sound pressure level of the noise.
- Whether the nature of the noise is usual or unusual.
- Whether the origin of the noise is natural or unnatural.
- The sound pressure level and octave band sound pressure level of the background noise, if any.
- The proximity of the noise to residential sleeping facilities.
- The nature and zoning of the area within which the noise emanates.
- The density of the inhabitation of the area within which the noise emanates.
- The time of the day or night when the noise occurs.
- The duration of the noise.
- Whether the noise is recurrent, intermittent, or constant.
- Whether the noise is produced by a commercial or noncommercial activity.

Local noise ordinances also exhibit other comparable sections and language, including but not limited to the following:

- Glossaries of legal terms and acoustical terminology, such as noise descriptors and noise-sensitive receivers/receptors.
- Sound measurement settings (e.g., "fast" or "slow" meter response, minimum measurement duration).
- Injunctions and remedies.
- Waivers.
- Exemptions or exclusions for emergency work.
- Maximum noise levels and/or allowable time periods for construction work.

Aside from noise threshold quantities appearing in Table B-1, unique or noteworthy features of the noise ordinances or general plan noise elements for each identified jurisdiction are indicated in the following brief summaries.

Table B-1
Summary of Local Noise Criteria for Affected Communities (dBA)

Jurisdiction	Residential		Commercial		Industrial		Institutional*		Notes
	Day	Night	Day	Night	Day	Night	Day	Night	
County of Fresno									
Noise Element rural (trans./stationary)	55 L_{dn} / 50 L_{50}	55 L_{dn} / 45 L_{50}	-	-	-	-	55 L_{dn} / 50 L_{50}	55 L_{dn} / 45 L_{50}	1
Noise Element urban (trans./stationary)	60 L_{dn} / 55 L_{50}	60 L_{dn} / 50 L_{50}	65 L_{50}	60 L_{50}	70 L_{50}	70 L_{50}	60 L_{dn} / 55 L_{50}	60 L_{dn} / 50 L_{50}	1
Noise Ordinance (all)	50 L_{50}	45 L_{50}					50 L_{50}	45 L_{50}	
County of Kings									
transportation source	60 CNEL	60 CNEL	65 CNEL	65 CNEL	65 CNEL	65 CNEL	60 CNEL	60 CNEL	1
stationary source	55 L_{eq}	50 L_{eq}	55 L_{eq}	-	60 L_{eq}	-	55 L_{eq}	-	1
County of Tulare									
transportation source	60 CNEL	60 CNEL	70 CNEL	70 CNEL	75 CNEL	75 CNEL	70 CNEL	70 CNEL	1
stationary source	50 L_{50}	45 L_{50}	-	-	-	-	50 L_{50}	45 L_{50}	1
County of Kern									
transportation source	65 L_{dn}	65 L_{dn}	-	-	-	-	65 L_{dn}	65 L_{dn}	1
stationary source	-	-	-	-	-	-	-	-	1
City of Fresno									
transportation source	60 L_{dn}	60 L_{dn}	-	-	-	-	60 L_{dn}	60 L_{dn}	1
stationary source	60 L_{25} (day) / 55 L_{25} (evening)	50 L_{25}	65 L_{25}	60 L_{25}	70 L_{25}	70 L_{25}	-	-	1
City of Hanford									
transportation source	60 L_{dn}	60 L_{dn}	-	-	-	-	60 L_{dn}	60 L_{dn}	1, 2
stationary source	50 L_{eq}	45 L_{eq}	-	-	-	-	-	-	1
City of Corcoran									
transportation source	65 CNEL	65 CNEL	-	-	-	-	65 CNEL	65 CNEL	1
stationary source									

Table B-1
Summary of Local Noise Criteria for Affected Communities (dBA)

Jurisdiction	Residential		Commercial		Industrial		Institutional*		Notes
	Day	Night	Day	Night	Day	Night	Day	Night	
City of Delano									
transportation source	65 CNEL	65 CNEL	70 CNEL	70 CNEL	75 CNEL	75 CNEL	65 CNEL	65 CNEL	1
stationary source	55 L_{eq}	50 L_{eq}	60 L_{eq}	55 L_{eq}	75 L_{eq}	65 L_{eq}	55 L_{eq}	50 L_{eq}	1
City of Wasco									
transportation source	65 L_{dn}	65 L_{dn}	-	-	-	-	65 L_{dn}	65 L_{dn}	1
stationary source	-	-	-	-	-	-	-	-	
City of Shafter									
transportation source	60–65 CNEL	60–65 CNEL	65–70 CNEL	65–70 CNEL	65–70 CNEL	65–70 CNEL	60 CNEL	60 CNEL	1
stationary source	-	-	-	-	-	-	-	-	
Metropolitan Bakersfield									
transportation source	60–65 CNEL	60–65 CNEL	70 CNEL	70 CNEL	75 CNEL	75 CNEL	70 CNEL	70 CNEL	1
stationary source	55 L_{50}	50 L_{50}	-	-	-	-	55 L_{50}	50 L_{50}	1
City of Bakersfield									
	-	-	-	-	-	-	-	-	1

Notes:
1. Exterior levels shown.2. At parks/playgrounds, 65 dBA L_{eq} during daytime from nontransportation sources and 70 dBA L_{dn} from transportation sources.

*Typical institutional land uses are for hospitals, churches, schools, libraries, and other similar structures.

Acronyms and Abbreviations:
CNEL = Community Noise Equivalent Level, dBA
dBA = A-weighted decibels
L_{dn} = day-night sound level, dBA
L_{eq} = equivalent sound level, dBA

Source: Compiled by URS Corporation in 2010.

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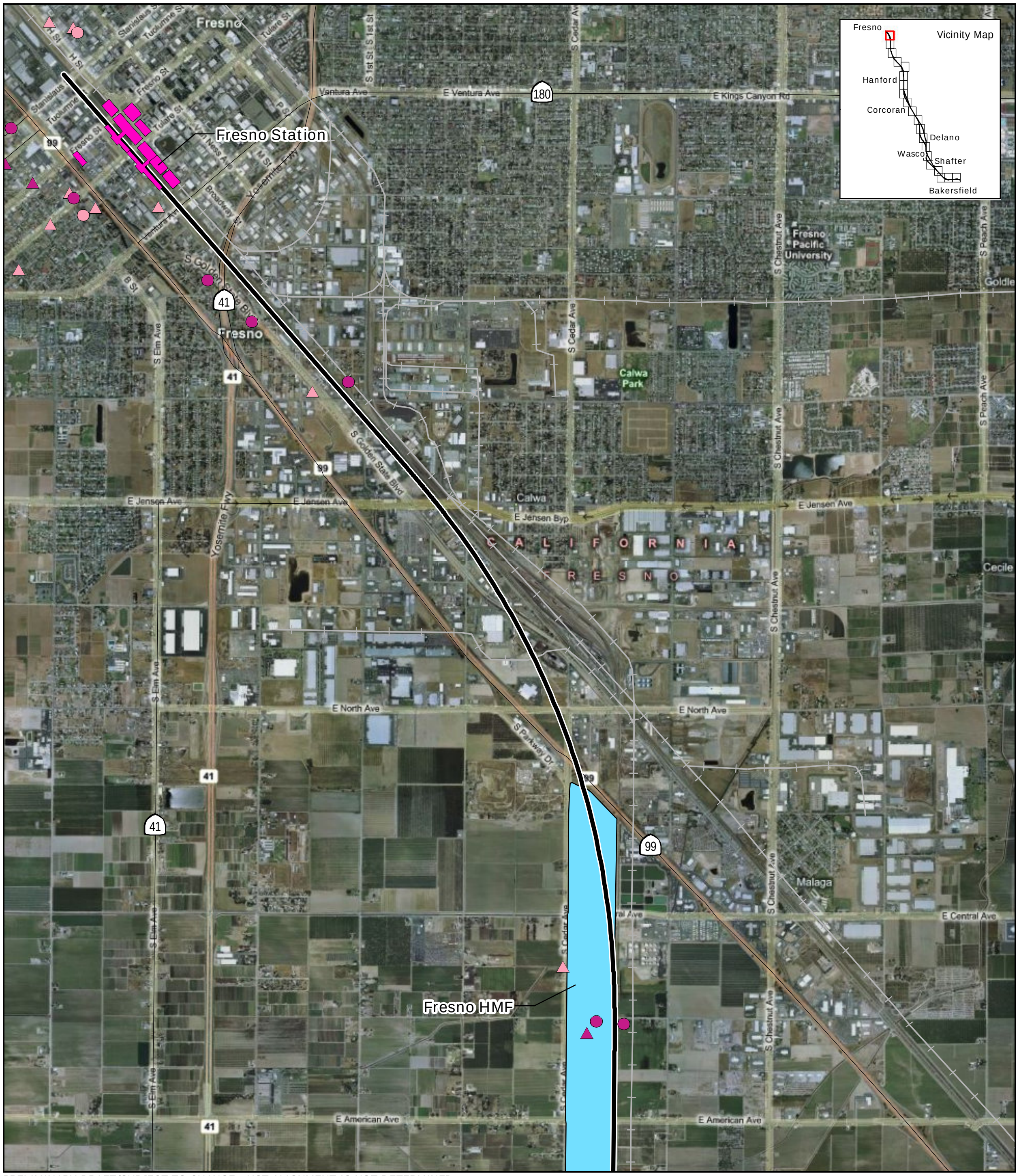
Appendix C
Noise Measurement Sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

0 1,000 2,000
Feet

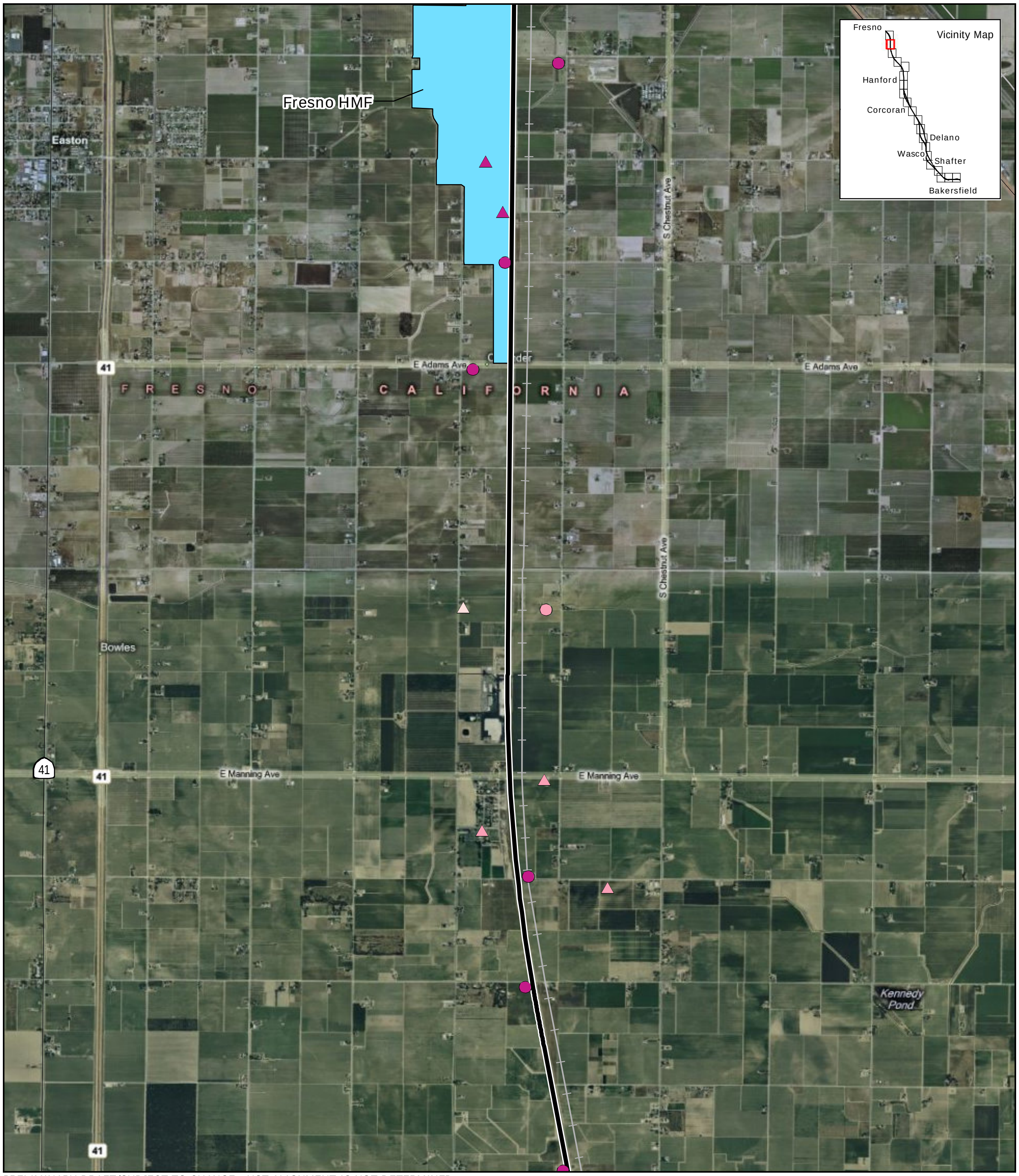
0 500 1,000
Meters

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure C-1
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

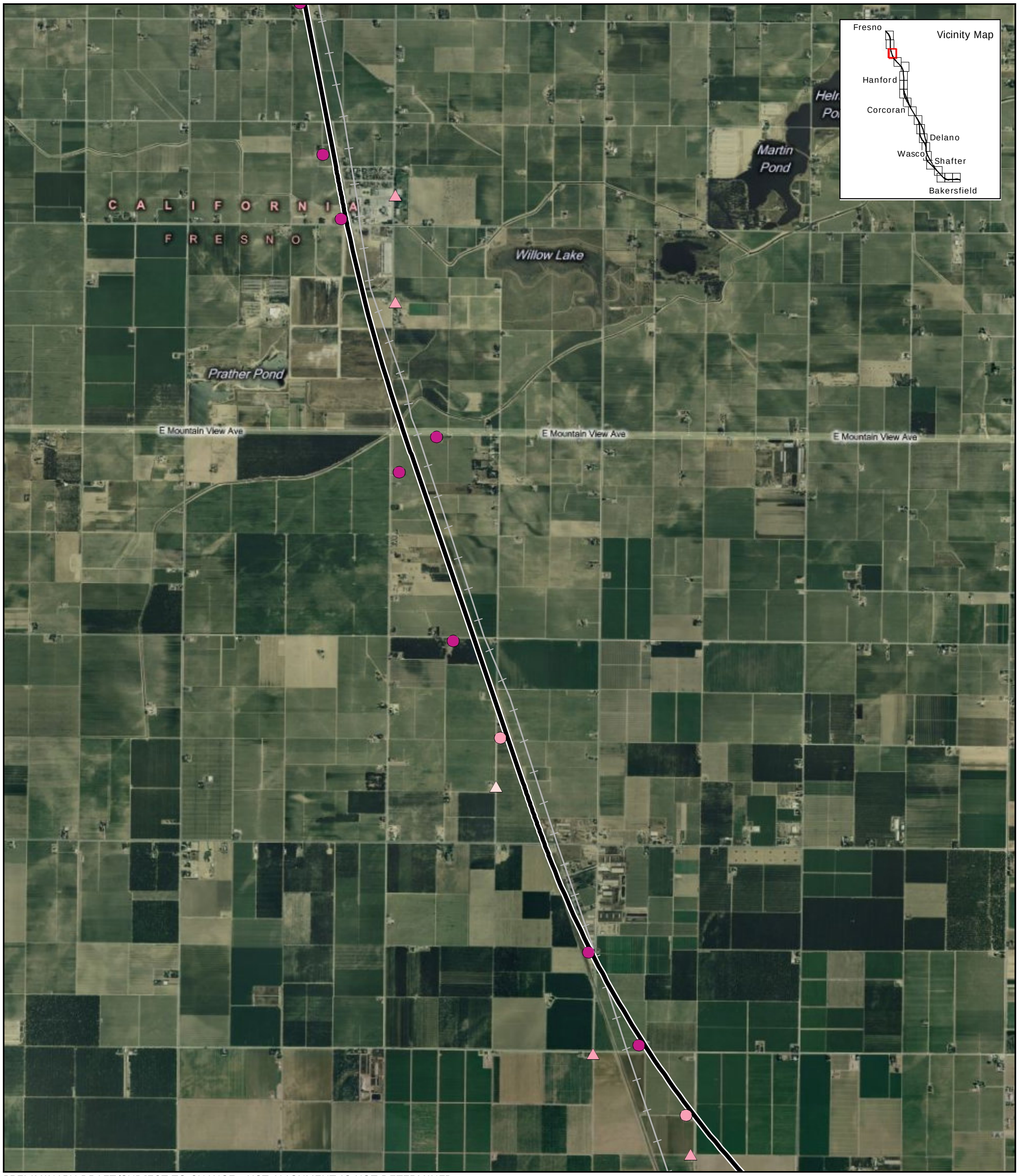
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-2
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-3
Noise and vibration measurement sites

Fresno County

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

Data source: URS, 2011

June 2, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

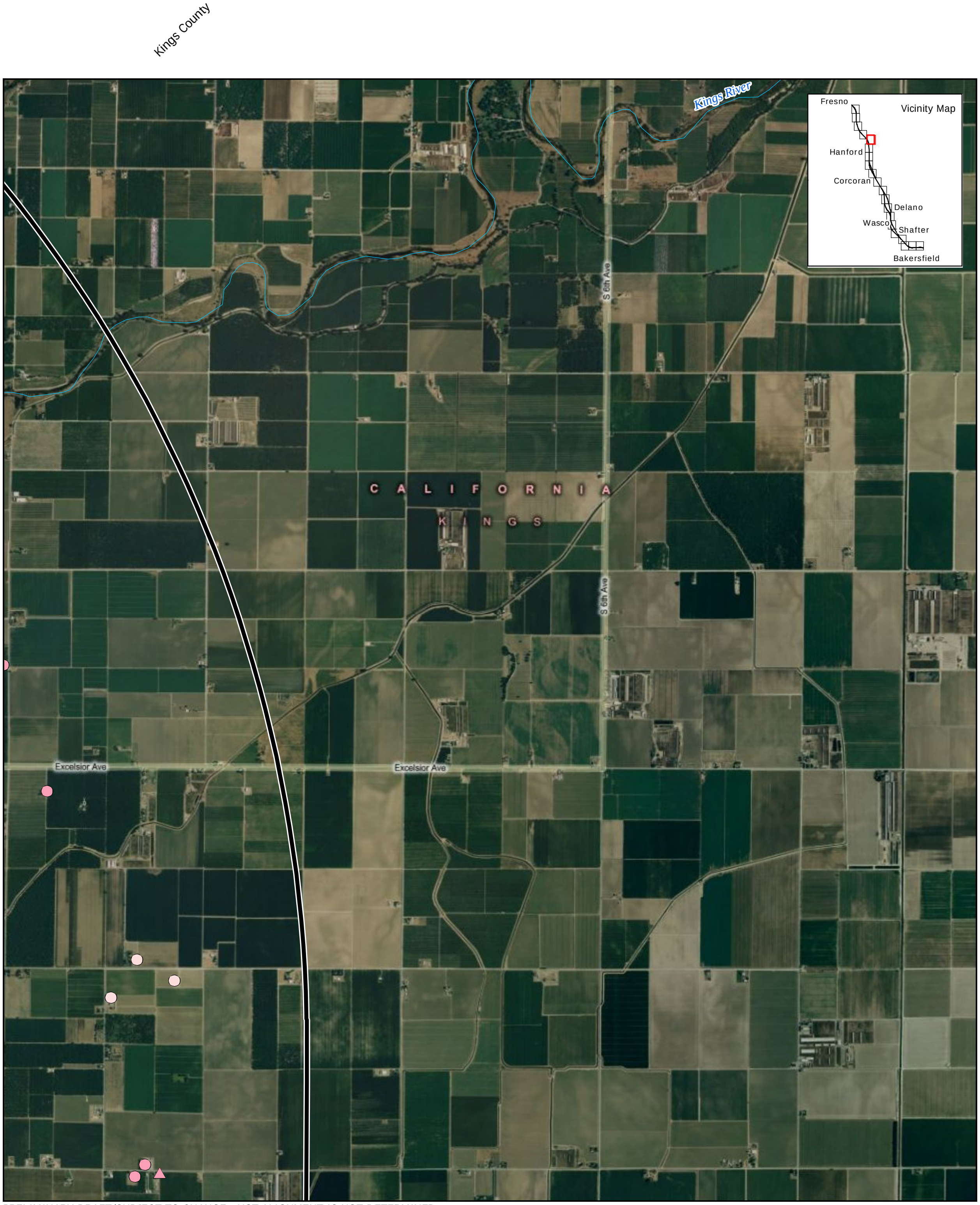
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-4
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

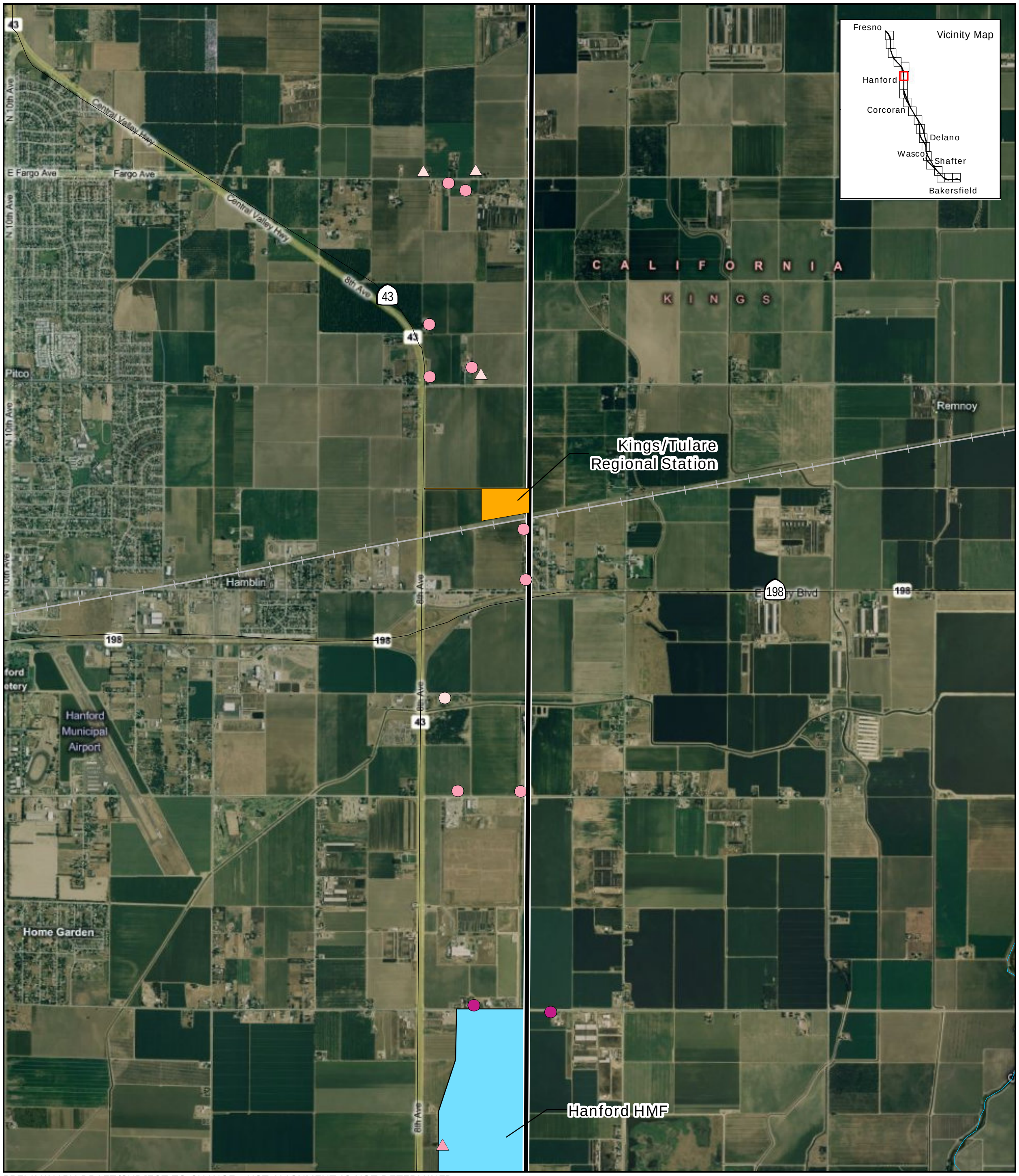
Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **C**-5
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011

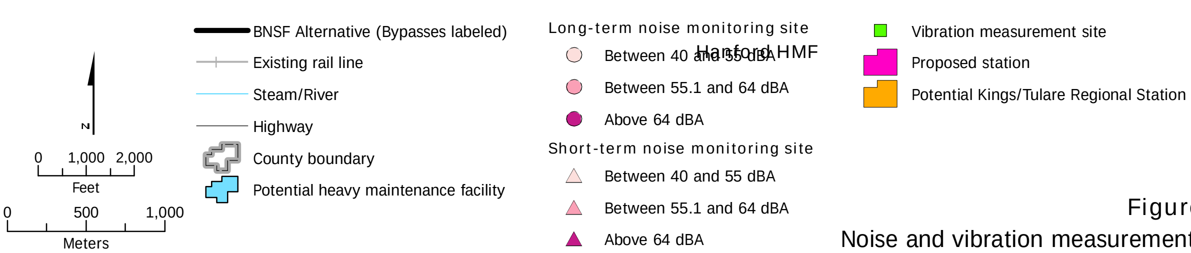
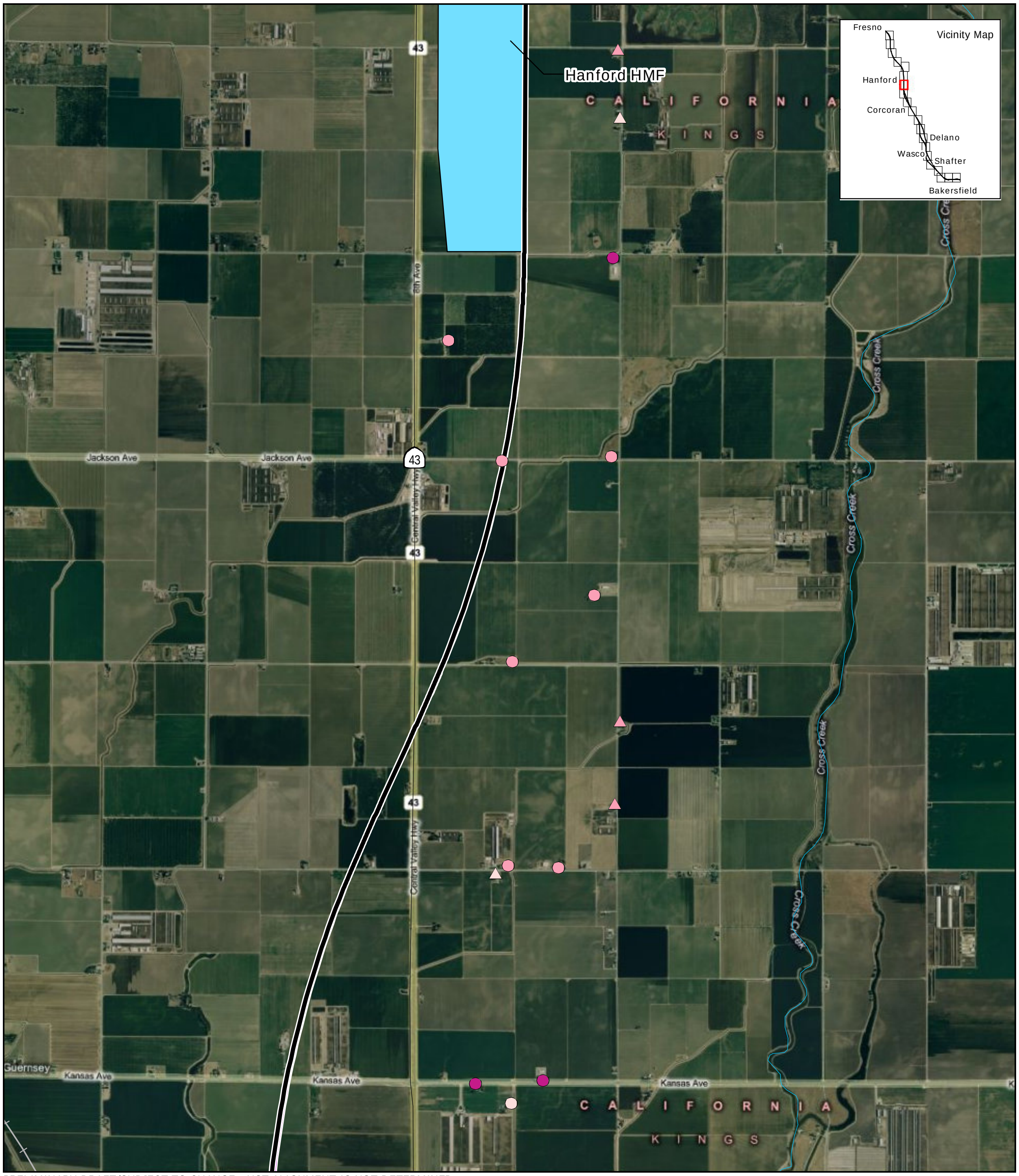
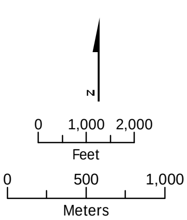


Figure **C**-6
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011



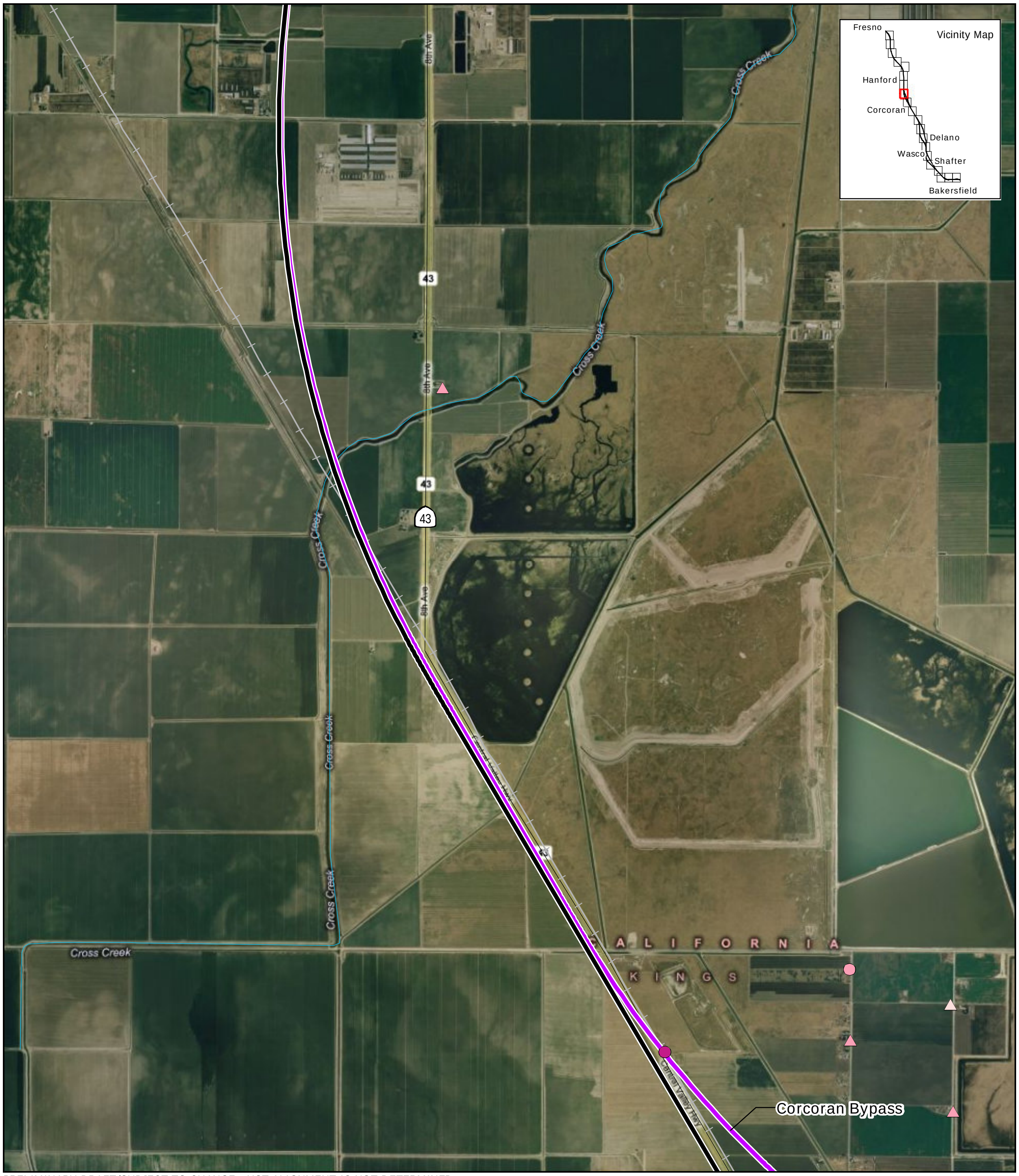
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-7
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

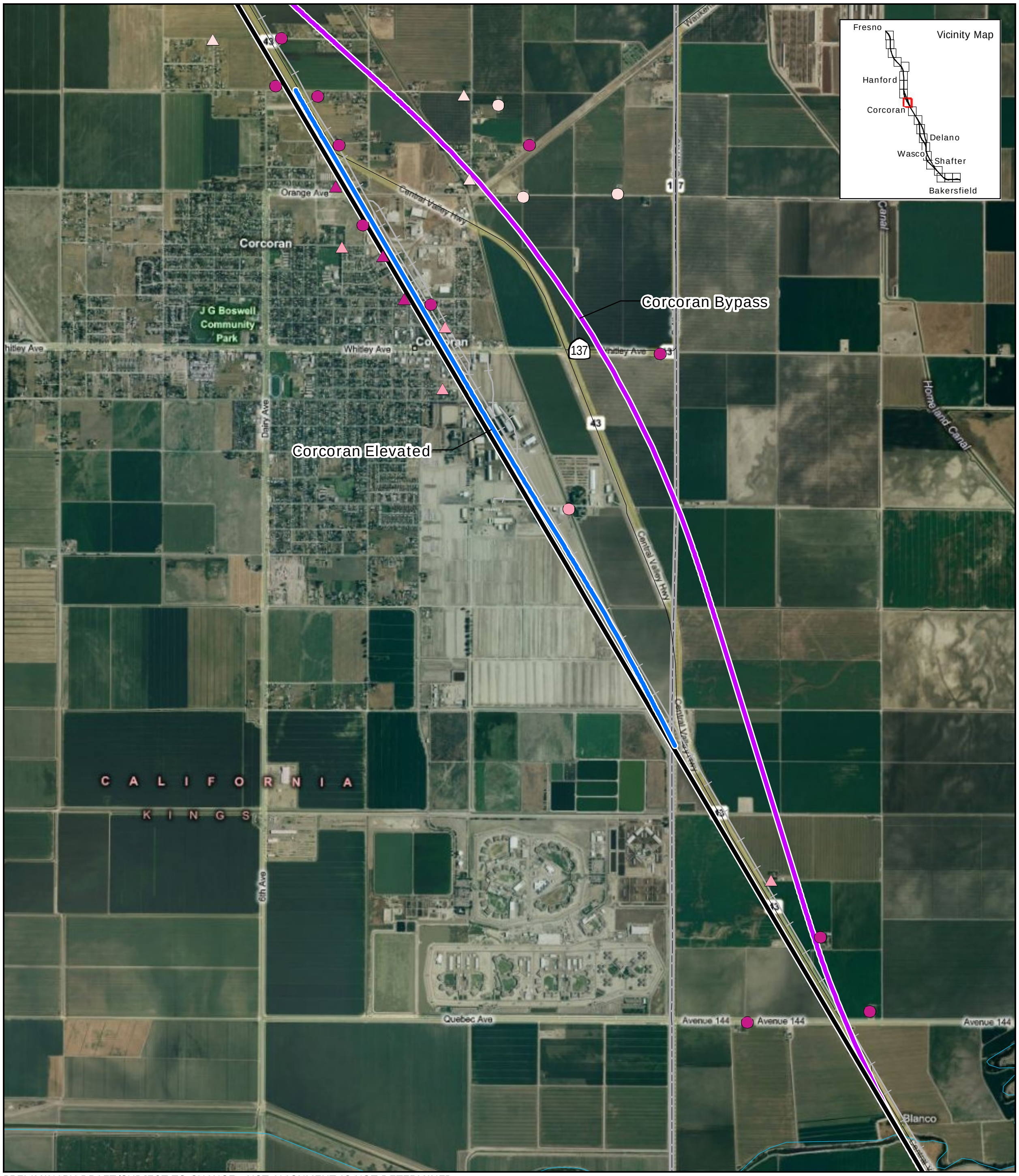
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

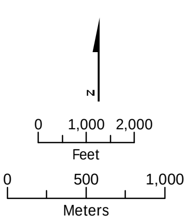
Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-8
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011



- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

- Vibration measurement site
- Proposed station
- Potential Kings/Tulare Regional Station

Figure C-9
Noise and vibration measurement sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

Data source: URS, 2011

June 2, 2011

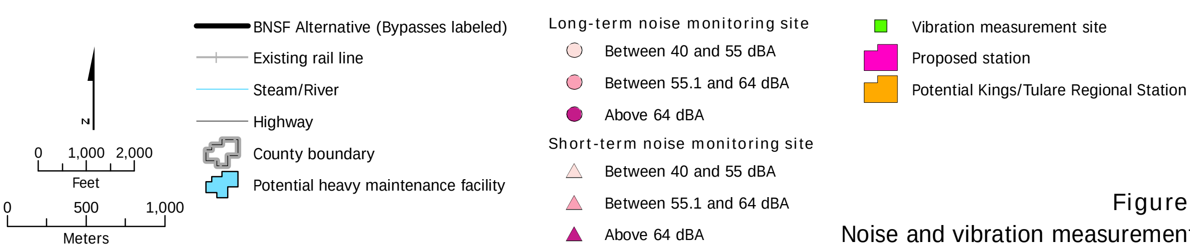


Figure **C**-10
Noise and vibration measurement sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

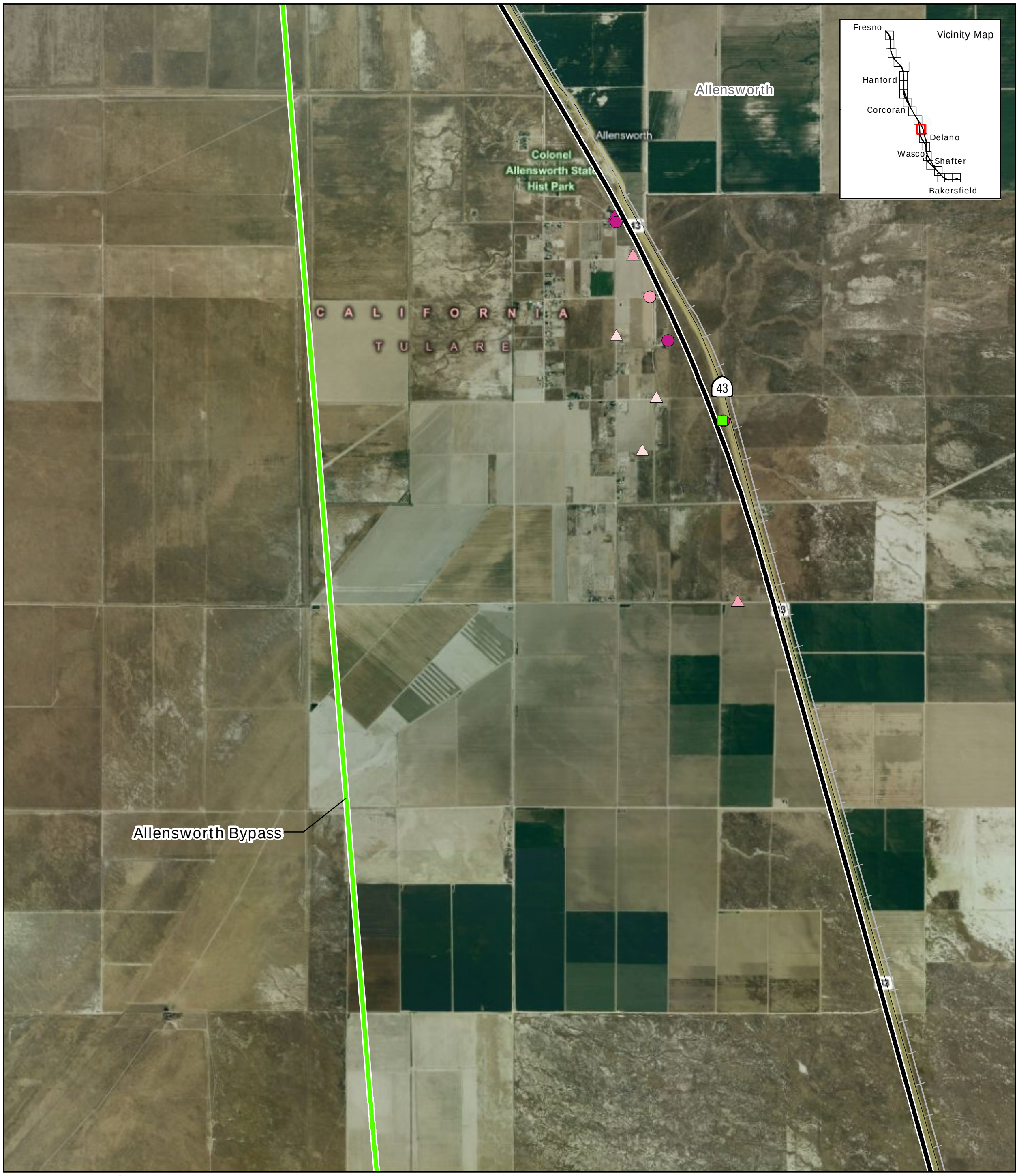
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

- Vibration measurement site
- Proposed station
- Potential Kings/Tulare Regional Station

Figure **C**-11
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

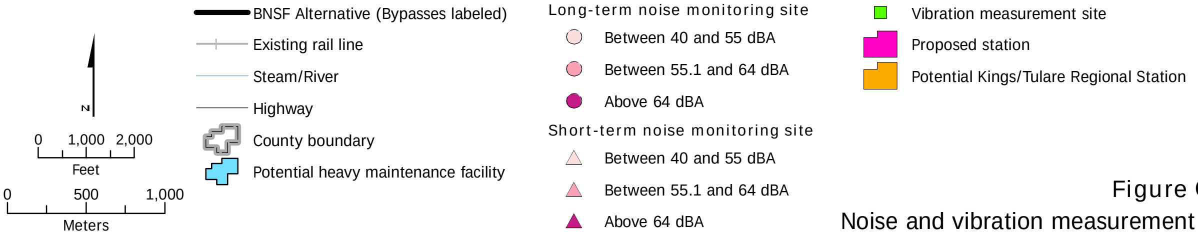
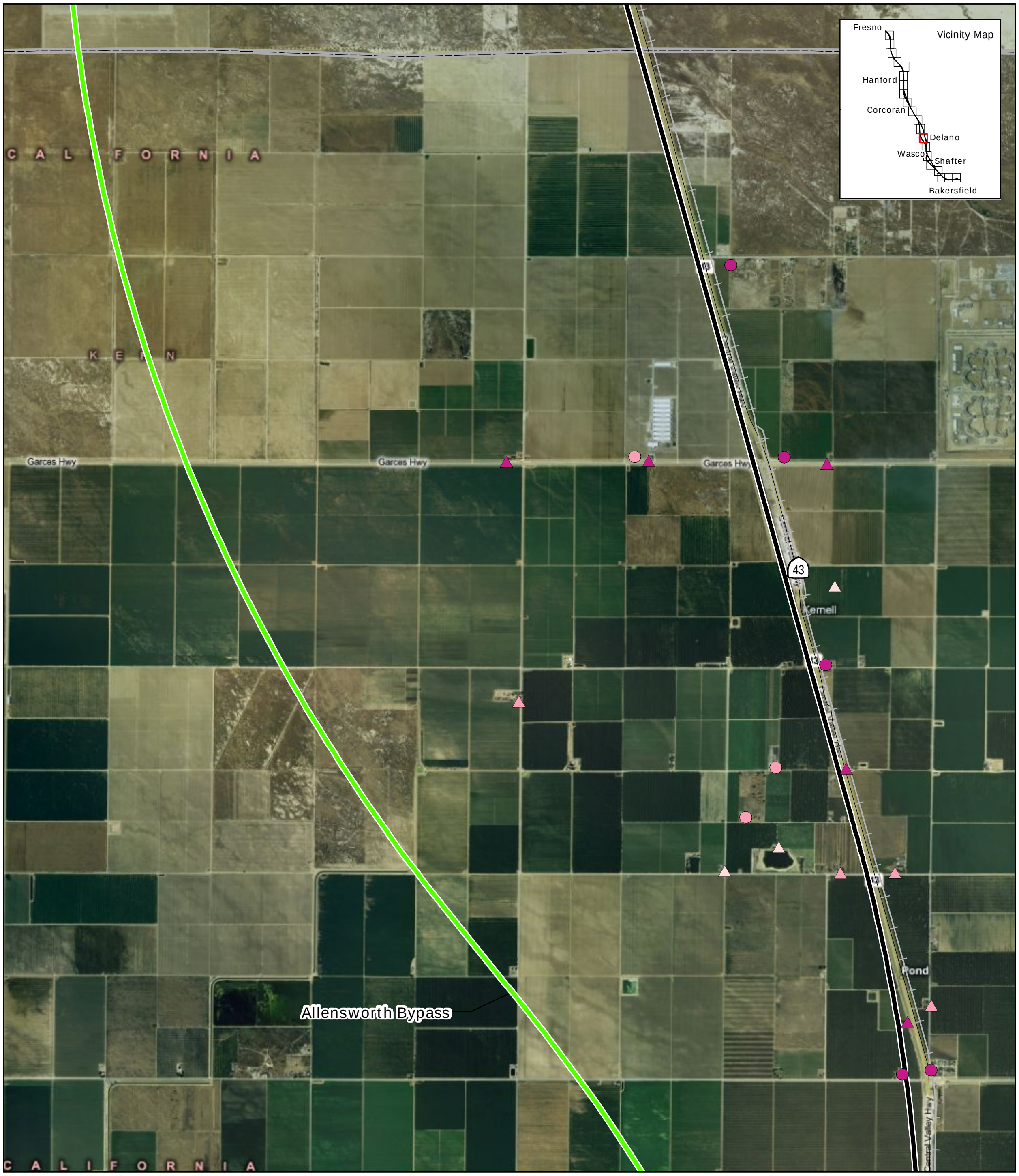


Figure **C**-12
Noise and vibration measurement sites

Delano



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Allensworth Bypass
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-13
Noise and vibration measurement sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

0 1,000 2,000
Feet

0 500 1,000
Meters

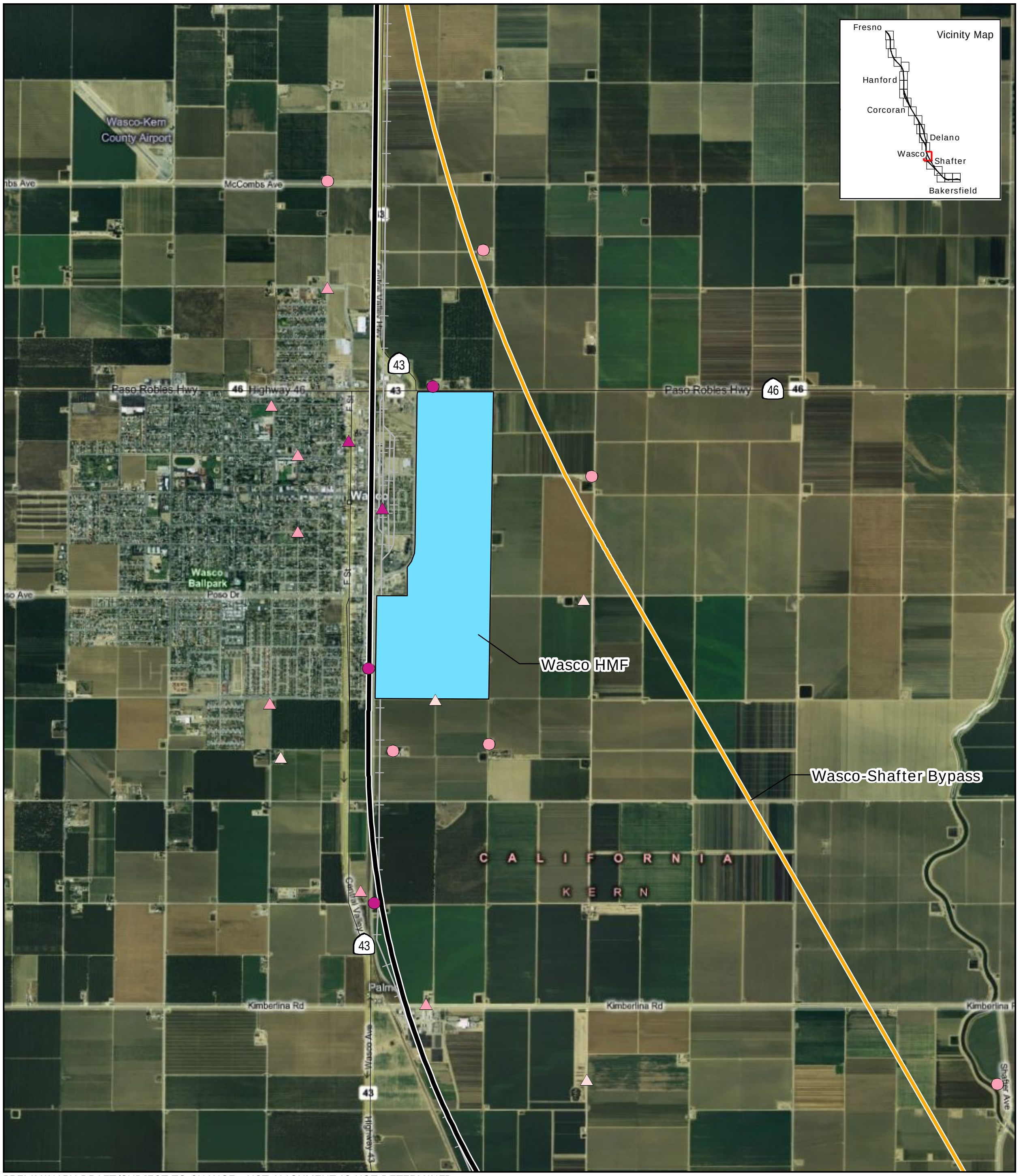
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

- Vibration measurement site
- Proposed station
- Potential Kings/Tulare Regional Station

Figure **C**-14
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

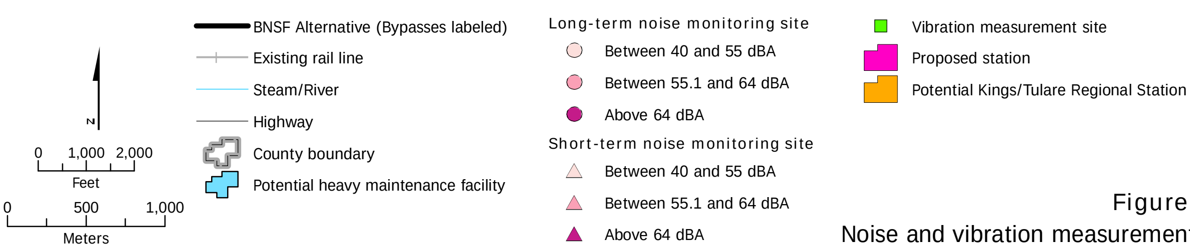
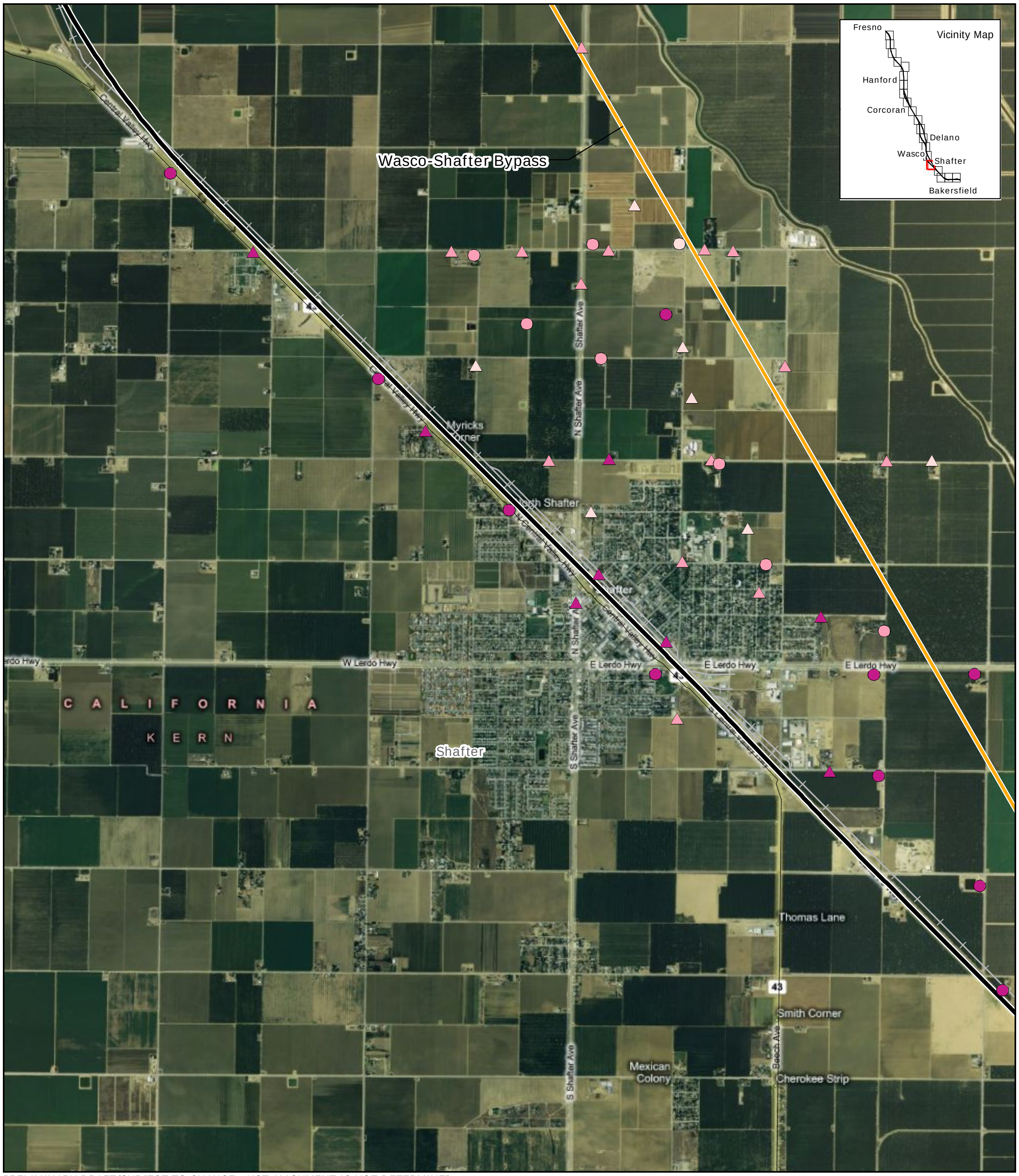


Figure **C**-15
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

Wasco

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-16
Noise and vibration measurement sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

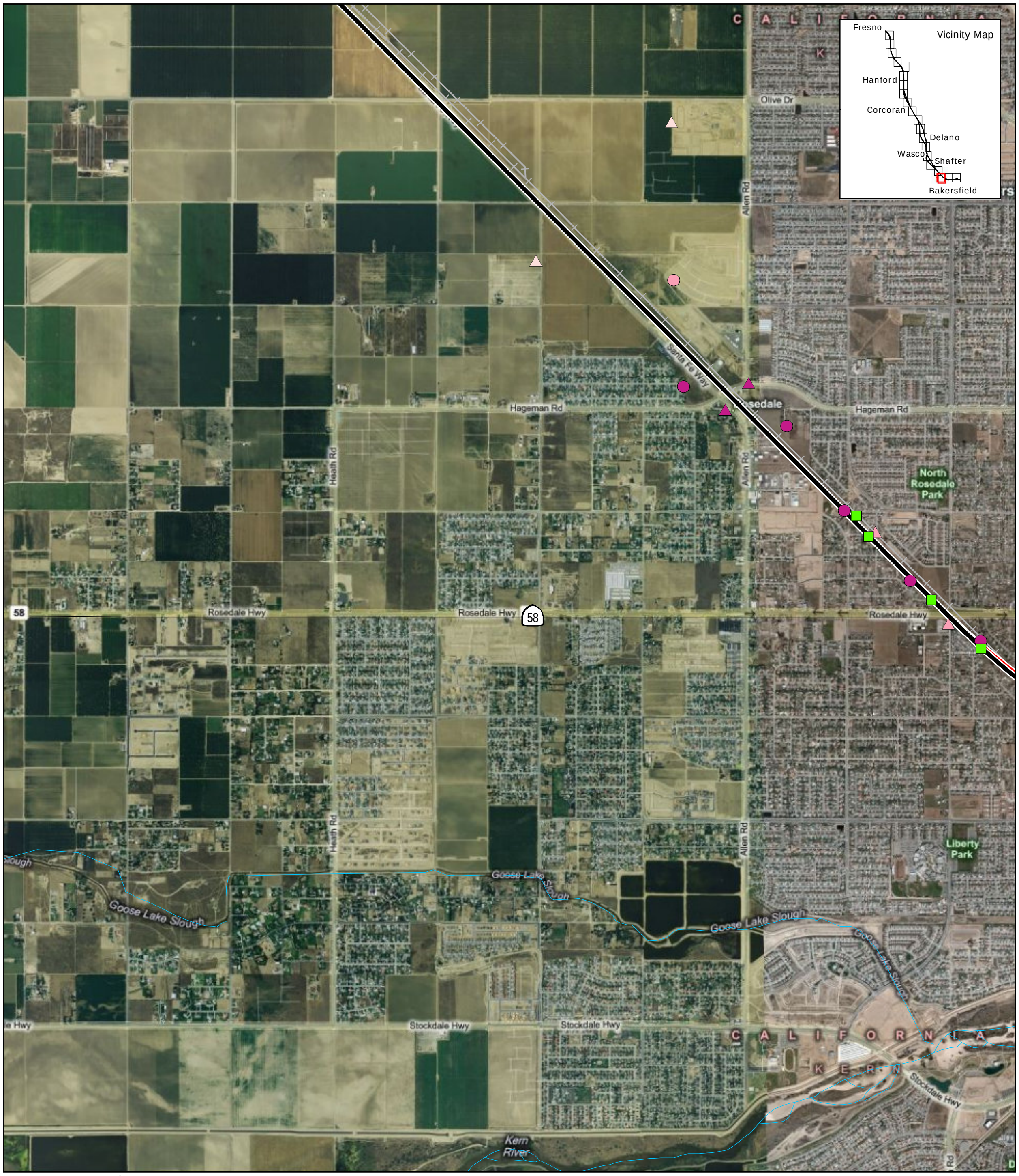
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

- Vibration measurement site
- Proposed station
- Potential Kings/Tulare Regional Station

Figure **C**-17
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011

0 1,000 2,000
Feet
0 500 1,000
Meters

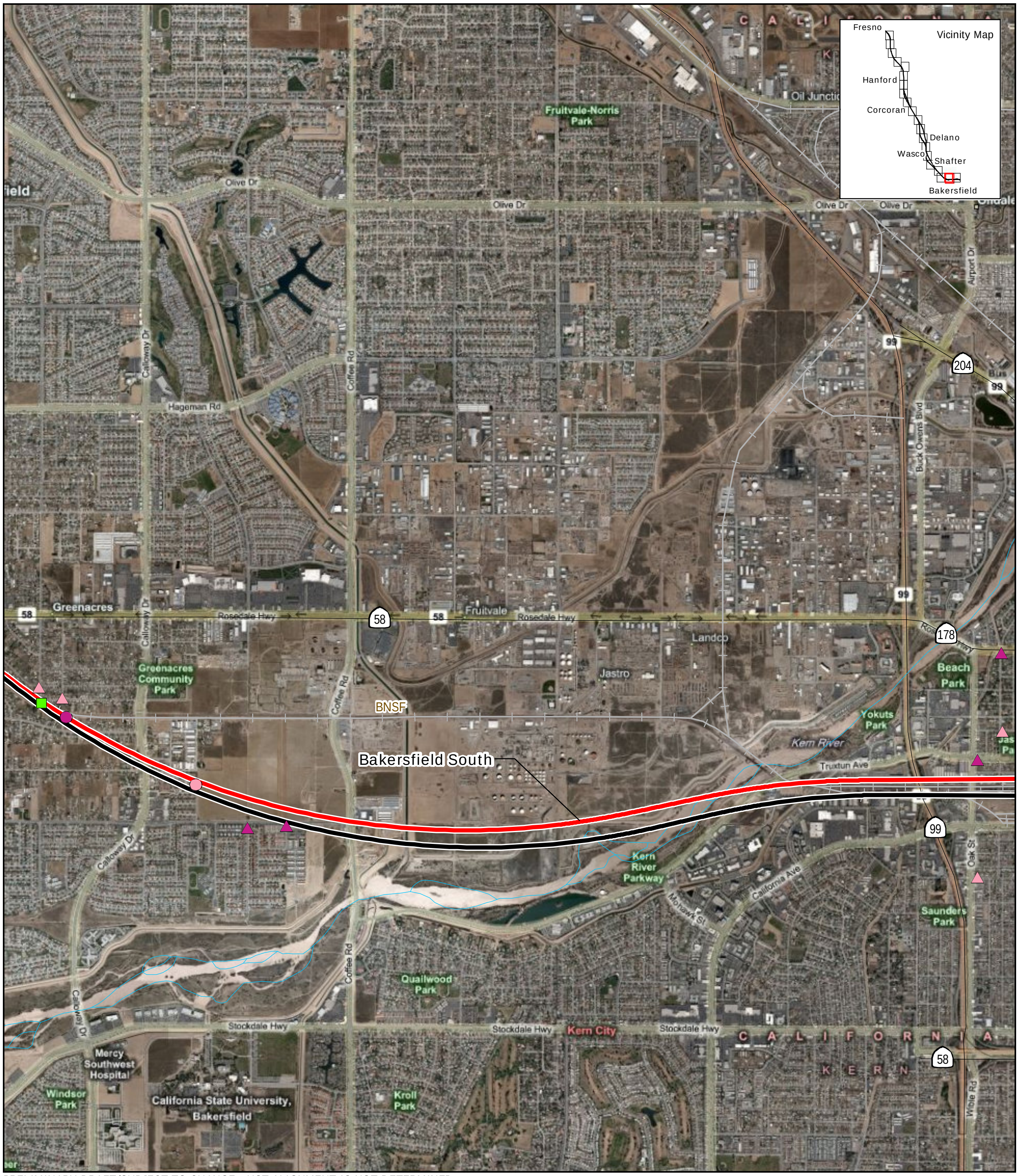
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-18
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility

Long-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

Short-term noise monitoring site
- Between 40 and 55 dBA
- Between 55.1 and 64 dBA
- Above 64 dBA

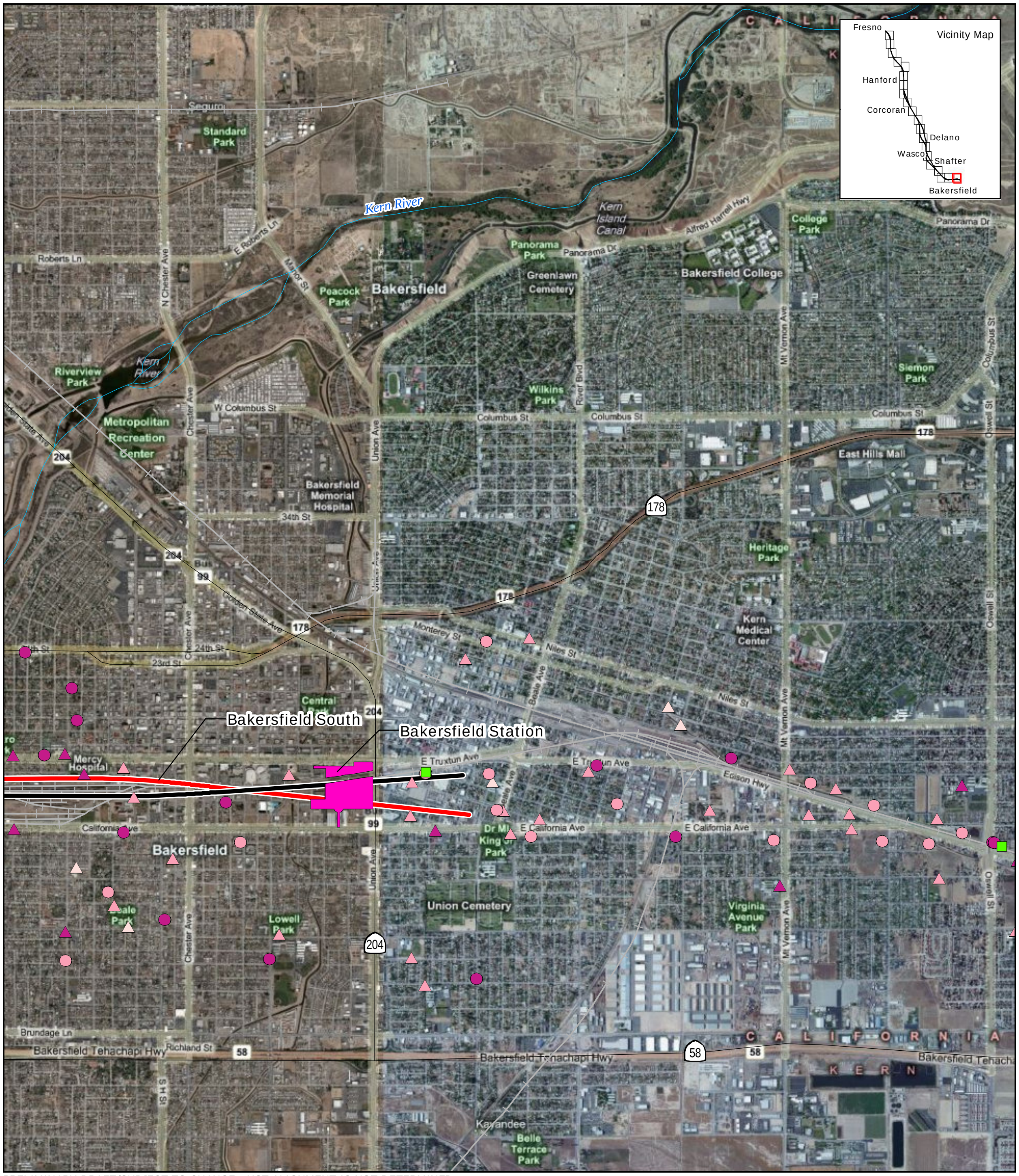
- Vibration measurement site
- Proposed station
- Potential Kings/Tulare Regional Station

N

0 1,000 2,000
Feet

0 500 1,000
Meters

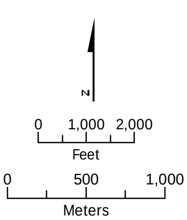
Figure **C**-19
Noise and vibration measurement sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011



BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility

Long-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Short-term noise monitoring site
Between 40 and 55 dBA
Between 55.1 and 64 dBA
Above 64 dBA

Vibration measurement site
Proposed station
Potential Kings/Tulare Regional Station

Figure **C**-20
Noise and vibration measurement sites

Appendix D
Field Noise Measurement Documentation and Detail

This appendix contains various exhibits and examples of how field noise measurements were documented and analyzed. These include:

- A table of field measurement equipment used (type, make, model, and calibration date) (Table D-1).
- A sample field measurement data sheet for a long-term noise measurement (Figure D-1).
- A sample field measurement data sheet for a short-term noise measurement (Figure D-2).
- Sample field photograph sets for the same long- and short-term measurement sites (Figures D-3 and D-4, respectively).
- Data analysis tables for long-term and short-term noise measurements (Tables D-2 and D-3, respectively).

A complete set of noise measurement data sheets and measurement site locations photographs are maintained as part of the project file. All of the long-term data sheets are included in Appendix D-1 (separate file), and all of the short-term data sheets are included in Appendix D-2 (separate file).

Table D-1
List of Acoustical Equipment Used

Type	Make	Model	Serial Number	Calibration Due Date
Type 1 Sound Level Meter	Larson Davis	820	1528	6/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1470	6/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1597	6/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1768	6/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1324	5/13/2010
Type 1 Sound Level Meter	Larson Davis	820	1655	6/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1651	8/27/2010
Type 1 Sound Level Meter	Larson Davis	820	1652	8/27/2010
Type 1 Sound Level Meter	Brüel and Kjær	2231	1413404	9/18/2010
Type 1 Sound Level Meter	Brüel and Kjær	2236	2015788	9/20/2010
Type 1 Sound Analyzer	Brüel and Kjær	2250	2672071	9/17/2010
Calibrator	Larson Davis	CAL200	2794	11/14/2010
Calibrator	Larson Davis	CAL150B	2233	8/26/2010
Calibrator	Brüel and Kjær	4231	1850301	9/17/2010

Source: Compiled by URS in 2010.

FIELD MEASUREMENT DATA SHEET

URS **Project Name:** Fresno to Bakersfield Labor **Job #** 27560811.53030100

ID

SITE IDENTIFICATION: LT-147 **OBSERVER(s):** TL & CM
START DATE & TIME: 2-15-10 11:27 **END DATE & TIME:** 2-16-10 11:46
ADDRESS: 2502 ZACHARY AVE (#1)
GPS coordinates: 35° 27.794' N 119° 10.872' W

Weather

TEMP: 60 °F HUMIDITY: 50 % R.H. WIND: **CALM LIGHT MODERATE VARIABLE**
WINDSPEED: 0-1 MPH DIR: N NE E SE S SW W NW **STEADY GUSTY** ___ MPH
SKY: **CLEAR SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN** Other: ______

Acoustic Measurements

INSTRUMENT: LDL 820 **TYPE:** 1 2 **SERIAL #:** 1597 GREEN
CALIBRATOR: **SERIAL #:**
CALIBRATION CHECK: **PRE-TEST** 94.0 **dBA SPL** **POST-TEST** 94.1 **dBA SPL** **WINDSCREEN** X
SETTINGS: **A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI OTHER:** ______

Rec #	Start Time / End Time	Leq	Lmax	L10	L50	L90	Lmin	
	/							
	/							
	/							
	/							

COMMENTS: DIRT ROAD ACCESS - FARM ACTIVITIES, TRACTOR

Source Info and Traffic Counts

PRIMARY NOISE(S): **TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER**
ROADWAY TYPE:

COUNT DURATION: ___ **-MINUTE**

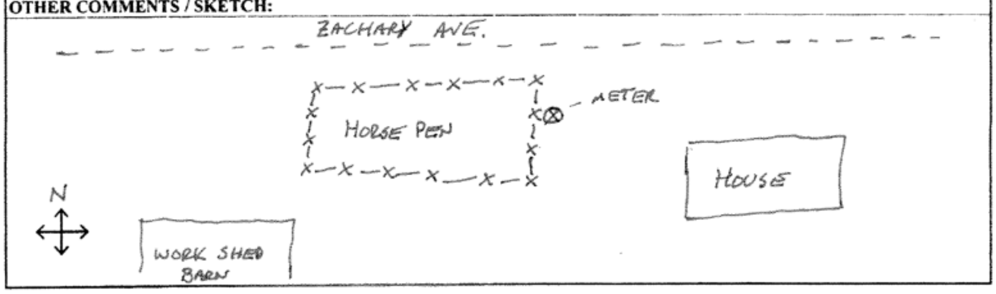
	NB EB / SB WB	SPEED (mph) NB EB / SB WB	#2 COUNT: NB EB / SB WB	SPEED (mph) NB EB / SB WB
AUTOS:	/	/	/	/
MED. TRUCKS:	/		/	
HVY TRUCKS:	/		/	
BUSES:	/		/	
MOTORCYCLES:	/		/	

SPEED ESTIMATED BY: **RADAR / DRIVING / OBSERVER**

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS**
OTHER:

Description / Sketch

TERRAIN: **HARD SOFT MIXED FLAT OTHER:**
PHOTOS: YES
OTHER COMMENTS / SKETCH:



2020 E. First Street, Suite 400, Santa Ana, CA 92705, 714-835-6886 fax 714-433-7701

Figure D-1
Sample long-term noise measurement data sheet

FIELD MEASUREMENT DATA SHEET

URS **Project Name:** Fresno to Bakersfield Labor **Job #** 27560811.53030100

ID

SITE IDENTIFICATION: ST-34 **OBSERVER(s):** PM / BV
START DATE & TIME: 11/11/09 11:20am **END DATE & TIME:** 11/11/09 12:20pm
ADDRESS: Corner of 4th street & F Street

GPS coordinates: N 35° 35' 52.6" W 119° 20' 02.0"

Weather

TEMP: 68.8 °F HUMIDITY: 45.8 % R.H. WIND: **CALM** **LIGHT** **MODERATE** **VARIABLE**
WINDSPEED: 0-1 MPH DIR: **N** **NE** **E** **SE** **S** **SW** **W** **NW** **STEADY** **GUSTY** ____ MPH
SKY: **CLEAR** **SUNNY** **DARK** **PARTLY CLOUDY** **OVRCST** **FOG** **DRIZZLE** **RAIN** Other: ________

Acoustic Measurements

INSTRUMENT: B & K 2236 **TYPE:** 1 2 **SERIAL #:** 2015788
CALIBRATOR: CAL 200 **SERIAL #:** 2494
CALIBRATION CHECK: **PRE-TEST** 93.9 **dBA SPL** **POST-TEST** 93.9 **dBA SPL** **WINDSCREEN** ✓
SETTINGS: **A-WEIGHTED** **SLOW** **FAST** **FRONTAL** **RANDOM** **ANSI** **OTHER:** ________

Rec #	Start Time / End Time	Leq	Lmax	L10	L50	L90	Lmin	
1	11:20am / 12:20pm	69.0	83.0	73.0	65.0	53.0	47.6	
	/							
	/							
	/							

COMMENTS: Train passed location @ 11:25am ; 11:37-11:38am ; 11:45am ; 12:15pm
- Steady low hum can be heard from auto shop ventilation when no vehicles are present.

Source Info and Traffic Counts

PRIMARY NOISE(S): **TRAFFIC** **AIRCRAFT** **RAIL** **INDUSTRIAL** **AMBIENT** **OTHER**
ROADWAY TYPE:

COUNT DURATION: ____ **-MINUTE**

	NB EB / SB WB	SPEED (mph) NB EB / SB WB	#2 COUNT: NB EB / SB WB	SPEED (mph) NB EB / SB WB
AUTOS:	/	/	/	/
MED. TRUCKS:	/		/	
HVY TRUCKS:	/		/	
BUSES:	/		/	
MOTORCYCLES:	/		/	

SPEED ESTIMATED BY: **RADAR** / **DRIVING** / **OBSERVER**

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS**
OTHER:

Description / Sketch

TERRAIN: **HARD** **SOFT** **MIXED** **FLAT** **OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:

measurms SIX

2020 E. First Street, Suite 400, Santa Ana, CA 92705, 714-835-6886 fax 714-433-7701

Figure D-2
Sample short-term noise measurement data sheet

	**Photograph 1** **Date:** 10/28/09 **Comments:** LT-9. SLM located in backyard. At the closest part of property to existing railway. Address: 4340 Sandy Gap Way, Bakersfield, CA
	**Photograph 2** **Date:** 02/17/10 **Comments:** LT-150. SLM located in northwest part of yard and parallel to residence. Address: 1636 Broadway Street, Fresno, CA

Figure D-3
Sample long-term noise measurement photo documentation

<table>
<tr><td></td><td>Photograph 3
Date: 11/11/09
Comments:
ST-35. SLM located at Wasco Child Development Center.

Address:
764 H Street, Wasco, CA</td></tr>
<tr><td></td><td>Photograph 4
Date: 12/03/09
Comments:
ST-82. SLM located at edge of property.

Address:
3764 Road 84, Allensworth, CA.</td></tr>
</table>

Figure D-4
Sample short-term noise measurement photo documentation

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Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information									
			Coordinates		Noise Sources																		
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-1	1331 M. Street	City of Bakersfield	35.37027778	-119.01577780			X					X		10/26/09	10:21:06	58.1	97.2	41.5	64.6	64.7	LDL 820	BV
LT-2	n/a	- -	- -	- -										- -	- -	- -	- -	- -	- -	- -	- -	- -
LT-3	9300 Windcreek Court	City of Bakersfield	35.37150000	-119.10563890			X	X				X	sprinklers	10/26/09	10:56:58	54.1	72.7	40.7	57.8	58.3	LDL 820	BV
LT-4	10304 Palm Ave	City of Bakersfield	35.37625000	-119.11683330									Ambient	10/27/09	13:53:00	67.3	89.2	33.8	71.6	71.8	LDL 820	BV
LT-5	1107 Enger St.	City of Bakersfield	35.38161111	-119.12527780									Ambient	10/27/09	14:13:10	67.6	97.7	29.0	71.5	71.7	LDL 820	RM
LT-6	2800 Lona Dala Dr.	City of Bakersfield	35.38586111	-119.13136110								X		10/27/09	14:50:01	70.5	101.7	31.6	74.0	74.2	LDL 820	RM
LT-7	3210 Old Farm Road	City of Bakersfield	35.39077778	-119.13705560	X							X		10/28/09	16:23:52	70.9	97.8	32.0	77.7	78.1	LDL 820	RM
LT-8	21541 Paddock Place	City of Bakersfield	35.39675000	-119.14205560	X		X							10/28/09	15:57:52	61.8	93.0	31.3	68.6	69.2	LDL 820	BV
LT-9	4340 Sandy Gap	City of Bakersfield	35.39952778	-119.15094440	X		X						rustling leaves	10/28/09	15:37:21	57.5	87.3	30.9	65.1	65.4	LDL 820	RM
LT-10	13417 Cheyenne Mtn. Dr.	City of Bakersfield	35.40702778	-119.15183330			X							11/2/09	9:49:38	51.1	82.9	30.6	59.6	59.6	LDL 820	BV
LT-11	19491 Santa Fe Way	City of Bakersfield	35.44294444	-119.20072220			X							11/2/09	9:06:23	71.7	103.9	30.3	78.8	78.9	LDL 820	RM
LT-12	19401 Santa Fe Way	City of Bakersfield	35.44825000	-119.20752780	X		X							11/2/09	9:26:58	66.3	89.8	37.1	72.8	72.9	LDL 820	BV
LT-13	31396 Burbank St.	City of Shafter	35.47077778	-119.23544440	X	X	X							11/3/09	10:22:25	67.8	101.2	30.6	74.4	74.6	LDL 820	RM
LT-14	31327 Orange St.	City of Shafter	35.47700000	-119.24141670	X		X							11/3/09	10:35:23	71.5	107.2	27.9	79.0	79.2	LDL 820	BV
LT-15	380 Marengo Ave.	City of Shafter	35.49922222	-119.27144440	X		X					X		11/3/09	11:03:50	62.6	95.1	34.4	69.6	69.8	LDL 820	RM
LT-16	396 Prince Lane	City of Shafter	35.51077778	-119.28411110			X							11/4/09	11:21:27	69.0	101.9	35.1	74.9	75.1	LDL 820	BV
LT-17	17422 Poplar Ave.	City of Shafter	35.52002778	-119.29544440	X		X						agricultural	11/4/09	11:37:39	73.4	102.6	32.5	79.4	79.6	LDL 820	RM
LT-18	17037 Scaroni Ave.	City of Shafter	35.53447222	-119.31344440	X		X							11/4/09	11:53:59	67.2	90.8	36.8	72.7	72.9	LDL 820	BV
LT-19	16202 Wasco Ave.	City of Wasco	35.56533333	-119.33158330	X		X					X	rustling leaves	11/5/09	12:16:28	67.1	91.4	31.9	72.8	73.3	LDL 820	RM
LT-20	15850 Wasco Ave.	City of Wasco	35.57608333	-119.33000000	X		X					X		11/5/09	12:39:25	53.0	86.4	27.0	59.9	60.2	LDL 820	BV
LT-21	29502 Unnamed Street, Wasco	City of Wasco	35.57658333	-119.32172220	X		X				X		Agricultural land	11/5/09	13:16:59	55.0	94.6	30.3	58.7	58.9	LDL 820	RM
LT-22	1886 G Street	City of Wasco	35.58188889	-119.33213890	X									11/11/09	9:46:38	67.6	100.1	35.1	73.2	73.8	LDL 820	BV
LT-23	29352 HWY 46 (Paso Robles Hwy)	City of Wasco	35.60180556	-119.32663890			X		X	X	X	X		11/11/09	10:12:49	67.7	93.2	44.6	73.4	73.8	LDL 820	RM
LT-24	29136 McCombs Road @ Annin Ave	City of Wasco	35.61625000	-119.33583330	X	X	X							11/11/09	10:44:06	58.5	92.8	32.3	63.0	63.6	LDL 820	BV
LT-25	29351 Whistler Road	City of Wasco	35.64475000	-119.32655560	X		X							11/12/09	11:13:24	56.5	84.8	22.3	62.7	62.8	LDL 820	RM
LT-26	13436 Hwy 43	City of Wasco	35.66408333	-119.33038890	X		X							11/12/09	11:50:27	66.5	97.5	20.7	72.0	72.1	LDL 820	BV
LT-27	29348 Blankenship Avenue	City of Wasco	35.66697222	-119.32661110	X		X							11/12/09	12:01:25	55.7	83.3	23.6	62.1	62.3	LDL 820	RM
LT-28	29350 Peterson Road	City of Wasco	35.70363889	-119.32744440	X		X						agricultural	11/16/09	8:42:58	58.9	93.6	26.3	67.2	67.4	LDL 820	BV
LT-29	29305 Second Street	City of Wasco	35.71836111	-119.33011110	X		X						Gardner @ noon	11/16/09	9:01:28	68.2	98.3	26.6	73.6	73.9	LDL 820	RM
LT-30	29140 Pond Road	City of Wasco	35.71805556	-119.33258330	X		X							11/16/09	9:20:04	64.6	95.5	27.3	72.3	72.5	LDL 820	BV
LT-31	13767 Cherry Ave.	City of Shafter	35.48436111	-119.24338890	X		X					X		11/17/09	11:11:38	70.3	101.0	34.5	71.1	71.2	LDL 820	RM
LT-32	1499 E. Los Angeles St.	City of Shafter	35.49208333	-119.25216670	X	X	X		X				Fence repairs 11/17 afternoon & 11/18 morning	11/17/09	11:57:24	57.3	94.2	33.5	64.4	64.6	LDL 820	BV

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-33	East Lerdo Hwy (between S. Beech Ave. and Cherry Ave)	City of Shafter	35.49925000	-119.25258330			X							11/17/09	11:50:30	62.2	82.1	30.4	67.2	67.4	LDL 820	RM
LT-34	1991 East Lerdo Hwy	City of Shafter	35.49930556	-119.24388890	X		X							11/18/09	13:14:59	61.7	80.7	33.0	66.6	66.9	LDL 820	BV
LT-35	460 Pine Street	City of Shafter	35.50697222	-119.26191670			X							11/18/09	14:21:18	56.3	94.6	21.9	59.4	59.5	LDL 820	RM
LT-36	1450 E. Lerdo Hwy	City of Shafter	35.50230556	-119.25172220	X		X		X					11/18/09	13:54:35	58.8	91.4	29.1	61.4	61.5	LDL 820	BV
LT-37	625 E. Fresno Ave.	City of Shafter	35.51408333	-119.26600000			X							11/19/09	15:20:58	55.8	93.8	35.4	58.6	58.7	LDL 820	RM
LT-38	30519 Madera Ave.	City of Shafter	35.52147222	-119.27625000									Ambient	11/19/09	15:21:55	56.8	80.5	40.1	59.5	59.6	LDL 820	BV
LT-39	17259 Shafter Ave.	City of Shafter	35.52461111	-119.27063890			X							11/19/09	14:51:26	64.1	88.0	39.3	69.2	69.4	LDL 820	RM
LT-40	17207 Mettler Ave.	City of Shafter	35.52875000	-119.28722220									Ambient	11/30/09	9:09:54	57.5	96.1	31.8	59.1	59.2	LDL 820	BV
LT-41	30348 Madera Ave.	City of Shafter	35.52391667	-119.28263890									Ambient	11/30/09	9:24:44	51.0	83.7	33.9	58.4	58.4	LDL 820	RM
LT-42	17096 Shafter Ave.	City of Shafter	35.52952778	-119.27697220									Ambient	11/30/09	9:40:43	54.7	77.5	41.1	61.6	61.8	LDL 820	BV
LT-43	30592 Merced Ave.	City of Shafter	35.52958333	-119.26950000									Ambient	11/30/09	9:55:58	49.0	81.0	34.5	53.7	53.9	LDL 820	RM
LT-44	28901 W. Cecil Way	City of Delano	35.77511111	-119.34772220			X							12/1/09	11:09:15	58.5	94.9	17.0	65.6	65.7	LDL 820	BV
LT-45	Garces Hwy @ Central Valley Hwy	City of Delano	35.76158333	-119.34302780	X	X	X							12/1/09	11:23:26	63.6	96.2	28.5	71.4	71.5	LDL 820	RM
LT-46	11098 Hwy 43 (Central Valley Hwy)	City of Delano	35.74694444	-119.33936110	X		X							12/1/09	11:39:53	67.5	89.7	25.6	73.1	73.2	LDL 820	BV
LT-47	11248 Airport Road	City of Wasco	35.73969444	-119.34366670	X								Ambient	12/1/09	12:22:33	54.4	84.6	22.9	59.9	60.2	LDL 820	RM
LT-48	8611 Avenue 32	City of Delano	35.84647222	-119.37502780			X							12/2/09	13:17:48	69.6	95.8	20.6	76.1	76.3	LDL 820	BV
LT-49	3400 Road 84, Earlimart	County of Tulare	35.85211111	-119.37986110	X		X							12/2/09	13:44:56	57.5	84.4	20.9	64.5	64.8	LDL 820	RM
LT-50	8512 Avenue 36, Earlimart	County of Tulare	35.85519444	-119.38147220	X		X							12/2/09	13:54:52	55.0	84.0	21.6	62.0	62.2	LDL 820	BV
LT-51	8369 Road 84, Earlimart, CA (@ Ave. 39)	County of Tulare	35.86044444	-119.38441670	X		X							12/2/09	14:10:49	61.6	96.6	21.3	68.7	68.9	LDL 820	RM
LT-52	9444 Hwy 43	County of Tulare	35.96051667	-119.45256670	X		X							12/3/09	14:40:15	57.6	93.2	29.3	64.4	64.6	LDL 820	BV
LT-53	9582 Hwy 43	County of Tulare	35.96250000	-119.45503330	X		X							12/3/09	15:02:43	57.5	92.1	29.6	64.0	64.3	LDL 820	RM
LT-54	9952 Hwy 43	County of Tulare	35.96981667	-119.45970000	X		X							12/3/09	15:19:35	57.2	84.0	25.1	64.6	64.8	LDL 820	BV
LT-55	3922 Avenue 120	City of Corcoran	36.00897222	-119.48561110	X		X		X					12/3/09	15:39:18	57.5	88.8	31.3	65.2	65.4	LDL 820	RM
LT-56	28704 Garces Hwy.	City of Delano	35.76158333	-119.35597220			X					X	rustling leaves	12/14/09	10:40:14	56.0	85.9	29.6	61.5	61.7	LDL 820	BV
LT-57	11446 Palm Ave.	City of Delano	35.73616667	-119.34625000	X							X	ambient	12/14/09	11:19:57	49.9	84.3	27.1	58.9	59.0	LDL 820	RM
LT-58	12728 Avenue 128	City of Corcoran	36.02158333	-119.49261110	X		X					X	ambient	12/15/09	10:11:38	61.5	92.7	25.7	64.9	65.2	LDL 820	BV
LT-59	2364 Ave. 144	City of Corcoran	36.05147222	-119.51922220	X		X					X		12/15/09	10:37:28	60.9	94.8	31.9	65.2	65.8	LDL 820	RM
LT-60	1847 Ave. 144	City of Corcoran	36.05063889	-119.52988890	X		X					x		12/15/09	12:19:10	65.1	88.9	33.1	70.4	70.7	LDL 820	BV
LT-61	14624 Hwy 43	City of Corcoran	36.05669444	-119.52355560	X		X					X		12/15/09	12:30:24	58.9	93.1	32.8	66.0	66.1	LDL 820	RM
LT-62	277 Oregon Ave.	City of Corcoran	36.08680556	-119.54563890	X		X		X					12/16/09	11:40:49	56.5	83.9	39.7	61.4	62.1	LDL 820	BV
LT-63	83 Whitley Ave.	City of Corcoran	36.09780556	-119.53777780	X		X							12/16/09	11:59:57	63.9	86.3	28.3	68.0	68.2	LDL 820	RM
LT-64	825 Yoder Blvd. @ Brokaw	City of Corcoran	36.10119444	-119.55777780	X		X							12/16/09	13:05:19	74.4	103.4	29.6	80.7	81.1	LDL 820	BV

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-65	1420 North Avenue	City of Corcoran	36.10675000	-119.56372220	X		X						apartments	12/16/09	13:27:40	73.6	104.6	33.4	78.4	78.8	LDL 820	RM
LT-66	5904 Newark, Corcoran	City of Corcoran	36.11991667	-119.57088890	X		X					X		12/17/09	12:28:00	59.0	83.5	27.1	64.4	64.6	LDL 820	BV
LT-67	1940 Dairy Ave.	City of Corcoran	36.11652778	-119.57136110	X		X							12/17/09	12:54:22	58.7	91.1	27.1	65.5	65.6	LDL 820	RM
LT-68	5701 Niles, Corcoran	City of Corcoran	35.52905556	-119.28305556	X		X							12/17/09	13:50:11	58.5	88.5	28.8	64.1	64.3	LDL 820	BV
LT-69	172 Orange Dr., Corcoran	City of Corcoran	36.10905556	-119.54158330			X					X	ambient	1/4/10	11:10:34	45.9	78.2	20.5	47.6	47.8	LDL 820	RM
LT-70	21 5th Avenue	City of Corcoran	36.11527778	-119.55200000								X		1/5/10	13:59:21	50.1	85.0	31.9	51.1	53.8	LDL 820	BV
LT-71	152 5 1/2 Avenue	City of Corcoran	36.11238889	-119.56583330			X					X		1/4/10	11:45:37	67.0	101.5	25.6	72.9	73.4	LDL 820	RM
LT-72	455 Orange Ave., Corcoran	City of Corcoran	36.10880556	-119.54977780			X					X	ambient	1/5/10	12:57:26	48.6	84.3	34.9	52.5	52.9	LDL 820	BV
LT-73	5974 Corcoran Hwy, Corcoran	City of Corcoran	36.11247222	-119.54927780			X							1/5/10	13:14:42	62.5	94.5	27.0	65.4	65.7	LDL 820	RM
LT-74	23088 51/2 Ave., Corcoran	City of Corcoran	36.13666667	-119.56338890			X						ambient	1/5/10	13:46:45	52.7	82.0	21.3	55.9	56.1	LDL 820	BV
LT-75	23489 Hwy 43	City of Corcoran	36.13075000	-119.57941670	X		X							1/6/10	14:36:44	66.3	87.1	20.9	71.7	71.8	LDL 820	RM
LT-76	7370 Kansas Ave.	City of Hanford	36.21111111	-119.58944440			X					X	ambient	1/6/10	15:03:05	67.9	89.8	26.0	72.6	72.8	LDL 820	BV
LT-77	7549 Kansas Ave	City of Hanford	36.20947222	-119.59216670			X						ambient	1/6/10	15:10:19	49.5	78.3	30.8	54.3	54.5	LDL 820	RM
LT-78	7685 Kansas Ave	City of Hanford	36.21086111	-119.59527780			X							1/6/10	15:21:00	66.5	89.7	34.9	71.0	71.3	LDL 820	BV
LT-79	7520 Kent Ave	City of Hanford	36.22625000	-119.59258330			X	X				X	agricultural	1/7/10	15:47:35	56.6	88.4	29.7	57.8	57.9	LDL 820	RM
LT-80	7290 Kent Ave	City of Hanford	36.22611111	-119.58816670	X		X					X	dog	1/7/10	15:59:00	52.2	79.9	23.9	55.7	55.9	LDL 820	BV
LT-81	7530 Jersey Ave	City of Hanford	36.24063889	-119.59230560			X					X	Ambient	1/25/10	08:45:29	56.6	94.8	26.1	57.3	57.9	LDL 820	RM
LT-82	15664 7th Ave	City of Hanford	36.24536111	-119.58519440			X					X	agricultural	1/25/10	09:01:20	55.4	86.7	27.3	58.5	59.0	LDL 820	BV
LT-83	7577 Jackson Ave	City of Hanford	36.25480556	-119.59330560			X							1/25/10	09:19:29	56.5	82.7	24.9	58.9	59.3	LDL 820	RM
LT-84	14976 7th Ave @ Jackson	City of Hanford	36.25516667	-119.58380560	X		X							1/25/10	09:34:59	56.3	82.0	25.5	58.0	58.5	LDL 820	BV
LT-85	14419 8th Ave	City of Hanford	36.26327778	-119.59805560			X							1/25/10	10:14:36	54.3	78.8	28.7	55.5	56.0	LDL 820	RM
LT-86	7025 Idaho Street	City of Hanford	36.26916667	-119.58375000			X		X				pump 75 yards away	1/26/10	10:08:27	59.6	80.5	52.1	65.2	65.4	LDL 820	BV
LT-87	7343 Houston Ave.	City of Hanford	36.29833333	-119.58938890			X							1/26/10	10:47:14	64.3	93.9	35.8	67.9	68.2	LDL 820	RM
LT-88	7740 Houston Ave.	City of Hanford	36.29880556	-119.59611110			X	X	X					1/26/10	10:57:30	61.5	85.3	25.9	64.9	65.3	LDL 820	BV
LT-89	7480 Hanford - Armona Road	City of Hanford	36.31388889	-119.59213890			X	X					Crop Dusters at location	1/26/10	11:10:35	54.3	76.4	31.9	57.9	58.3	LDL 820	RM
LT-90	7818 Hanford - Armona Road	City of Hanford	36.31391667	-119.59761110			X	X				X		1/26/10	11:19:46	57.1	89.1	31.8	58.3	58.6	LDL 820	BV
LT-91	10535 8th Avenue	City of Hanford	36.32047222	-119.59880560			X	X				X		1/27/10	11:53:11	48.3	77.3	31.0	52.3	52.8	LDL 820	RM
LT-92	9944 Ponderosa	City of Hanford	36.32886111	-119.59183330			X		X			X	Ambient	1/27/10	12:09:33	56.2	73.4	29.4	60.2	60.8	LDL 820	BV
LT-93	9724 Ponderosa	City of Hanford	36.33238889	-119.59200000			X	X		X		X	Roosters	1/27/10	12:21:28	51.7	84.6	29.3	55.3	55.9	LDL 820	RM
LT-94	7794 Grangeville Blvd	City of Hanford	36.34380556	-119.59661110			X					X	Rustling Leaves	1/27/10	12:44:31	51.9	88.9	30.1	56.0	56.6	LDL 820	BV
LT-95	7974 Grangeville Blvd	City of Hanford	36.34313889	-119.60030560			X							1/27/10	13:09:31	56.5	79.7	27.9	60.4	60.8	LDL 820	RM
LT-96	8791 8th Avenue	City of Hanford	36.34683333	-119.60036110			X							1/28/10	12:23:04	55.4	79.9	29.2	59.5	59.9	LDL 820	BV
LT-97	8361 Flint Ave.	City of Hanford	36.37119444	-119.60716670			X	X	X			X		1/28/10	13:28:19	51.8	85.9	24.8	55.3	55.6	LDL 820	RM
LT-98	8290 Flint Ave.	City of Hanford	36.37208333	-119.60625000			X			X			Fountain / Pool	1/28/10	13:40:10	52.8	84.4	23.9	56.0	56.3	LDL 820	BV

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-99	7895 Fargo Ave.	City of Hanford	36.35680556	-119.59875000			X	X				X		1/28/10	13:54:01	56.0	94.0	31.5	58.5	58.7	LDL 820	RM
LT-100	7755 Fargo Ave.	City of Hanford	36.35627778	-119.59725000	X		X	X				X		1/28/10	14:06:00	60.2	95.9	28.4	60.6	60.7	LDL 820	BV
LT-101	6141 8 1/2 Avenue	City of Hanford	36.38430556	-119.60944440			X		X			X	Ambient	2/1/10	08:31:40	47.9	84.7	26.4	49.6	49.8	LDL 820	RM
LT-102	8352 Elder Ave.	City of Hanford	36.38711111	-119.60708330			X						Ambient	2/1/10	08:46:56	45.8	75.0	27.4	48.8	49.1	LDL 820	BV
LT-103	8125 Elder Ave.	City of Hanford	36.38558333	-119.60366670			X						Ambient	2/1/10	09:01:30	43.8	66.2	26.2	46.7	46.9	LDL 820	RM
LT-104	8813 Excelsior Ave.	City of Hanford	36.39944444	-119.61536110				X				X		2/1/10	09:20:07	62.3	97.7	26.7	63.0	64.2	LDL 820	BV
LT-105	4490 9th Avenue	City of Hanford	36.40869444	-119.61938890			X					X		2/1/10	09:36:20	57.1	85.3	26.6	57.5	59.7	LDL 820	RM
LT-106	3739 9 1/2 Avenue	City of Hanford	36.41947222	-119.62733330								X	Ambient	2/2/10	09:58:47	47.9	73.3	23.2	49.9	50.5	LDL 820	BV
LT-107	10560 Denver Ave.	City of Hanford	36.43100000	-119.64683330	X		X					X	Rooster	2/2/10	10:20:35	53.3	90.2	21.5	53.8	53.8	LDL 820	RM
LT-108	3127 10 1/2 Avenue	County of Fresno	36.42891667	-119.64452780					X			X		2/2/10	10:41:03	47.7	69.4	24.3	50.6	51.0	LDL 820	BV
LT-109	2853 Boundry Road, Laton	County of Fresno	36.43255556	-119.64791670			X					X	Ambient	2/2/10	10:57:34	55.3	86.8	22.7	61.3	61.5	LDL 820	RM
LT-110	8066 E. Riverdale	County of Fresno	36.43816667	-119.65341670			X		X			X	Ambient	2/2/10	11:08:18	59.8	90.1	20.8	63.1	63.3	LDL 820	BV
LT-111	5606 Davis Ave.	County of Fresno	36.47458333	-119.69863890			X	X				X		2/3/10	11:34:25	53.3	78.1	25.1	56.9	57.1	LDL 820	RM
LT-112	5083 E. Elkhorn Ave.	County of Fresno	36.48900000	-119.70658330			X					X		2/3/10	11:58:06	59.2	86.4	20.8	63.5	63.7	LDL 820	BV
LT-113	16257 S. Minnewawa Ave.	County of Fresno	36.49922222	-119.71080560				X				X	Ambient	2/3/10	12:09:20	64.7	102.1	20.1	73.4	73.5	LDL 820	RM
LT-114	4224 Clarkson Ave.	County of Fresno	36.50416667	-119.71500000	X									2/3/10	12:21:26	61.3	93.0	20.4	66.3	66.4	LDL 820	BV
LT-115	15521 Peach Ave.	County of Fresno	36.51069444	-119.71944440	X		X					X		2/4/10	13:23:41	69.0	105.9	24.1	74.1	74.1	LDL 820	RM
LT-116	14474 Willow Ave.	County of Fresno	36.52577778	-119.72733330	X							X		2/4/10	13:12:56	59.5	85.2	27.0	63.7	63.8	LDL 820	BV
LT-117	3289 Kamm Ave.	County of Fresno	36.53258333	-119.73152780	X		X						Ambient	2/4/10	13:38:12	60.9	104.3	25.3	64.5	64.7	LDL 820	RM
LT-118	13198 Chestnut Ave.	County of Fresno	36.54447222	-119.73633330	X		X					X		2/4/10	13:53:39	63.6	94.9	24.5	70.2	70.4	LDL 820	BV
LT-119	2313 Mountain View Ave.	City of Fresno	36.54697222	-119.73311110	X		X					X		2/4/10	14:31:59	60.8	92.9	25.0	67.6	67.8	LDL 820	RM
LT-120	2960 E. Nebraska Ave.	City of Fresno	36.56230556	-119.74158330	X		X		X			X		2/8/10	08:59:05	70.5	104.0	32.8	77.0	77.1	LDL 820	BV
LT-121	2625 E. Rose Ave.	City of Fresno	36.56683333	-119.74322220	X		X					X		2/8/10	09:13:03	60.2	94.0	24.3	65.8	66.0	LDL 820	RM
LT-122	2530 E. Floral Ave.	City of Fresno	36.57750000	-119.74533330	X		X							2/8/10	09:29:44	69.4	103.8	21.9	75.1	75.2	LDL 820	BV
LT-123	2311 E. Dinuba Ave.	City of Fresno	36.59047222	-119.74875000	X							X		2/8/10	09:58:10	59.8	87.1	19.5	64.4	64.6	LDL 820	RM
LT-124	2342 E. Springfield Ave.	City of Fresno	36.59827778	-119.74858330	X							X		2/8/10	10:11:25	65.2	99.4	21.5	70.2	70.7	LDL 820	BV
LT-125	8179 S. Maple Ave.	City of Fresno	36.61708333	-119.74719440	X		X						Ambient	2/8/10	09:07:34	54.9	86.5	21.7	58.1	59.1	LDL 820	RM
LT-126	2047 E. Adams Ave.	City of Fresno	36.63400000	-119.75380560	X	X	X							2/10/10	12:40:12	60.1	91.2	27.4	66.8	66.9	LDL 820	BV
LT-127	2070 E. Clayton Ave.	City of Fresno	36.64158333	-119.75105560	X	X	X							2/9/10	12:37:34	64.9	97.7	23.2	65.9	65.9	LDL 820	RM
LT-128	5511 S. Maple Ave.	City of Fresno	36.65566667	-119.74650000			X		X				Roosters, rain	2/9/10	12:51:59	60.2	80.3	29.8	64.9	65.0	LDL 820	BV
LT-129	2235 E. Malaga Ave.	City of Fresno	36.67027778	-119.74963890	X		X					X		2/9/10	13:09:34	73.8	105.3	38.9	79.3	79.3	LDL 820	RM
LT-130	2109 E. Malaga Ave.	City of Fresno	36.67044444	-119.75202780	X		X							2/9/10	13:20:51	64.8	94.4	38.9	69.4	69.5	LDL 820	BV
LT-131	n/a	- -	- -	- -										- -	- -	- -	- -	- -	- -	- -	- -	- -
LT-132	2366 S. Grace	City of Fresno	36.71541667	-119.77419440	X		X							2/9/10	11:44:40	68.5	101.4	37.7	75.2	75.7	LDL 820	RM

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-133	2201 Nicholas Ave.	City of Fresno	36.71961111	-119.78269440			X							2/9/10	12:15:17	66.5	89.7	41.0	70.8	71.1	LDL 820	BV
LT-134	205 F Street	City of Fresno	36.72250000	-119.78661110			X							2/10/10	14:11:08	64.3	99.1	43.9	68.5	68.8	LDL 820	RM
LT-135	158 N. Roosevelt Ave.	City of Fresno	36.74511111	-119.80544440			X							2/10/10	14:26:55	65.0	95.5	41.0	69.0	69.5	LDL 820	BV
LT-136	239 N. Ferger Ave.	City of Fresno	36.74652778	-119.80730560			X							2/10/10	14:46:30	65.1	94.0	48.3	68.3	68.6	LDL 820	RM
LT-137	718 Arthur Ave	City of Fresno	36.75250000	-119.81525000			X							2/10/10	14:59:39	67.3	90.9	40.0	71.8	72.2	LDL 820	BV
LT-138	425 N. Westley Ave.	City of Fresno	36.74897222	-119.81500000	X		X							2/10/10	13:38:01	56.9	80.1	40.9	61.8	62.3	LDL 820	RM
LT-139	937 N. Fruit Ave	City of Fresno	36.75511111	-119.81788890			X							2/10/10	15:15:46	63.2	91.4	41.9	68.8	69.2	LDL 820	BV
LT-140	1219 N. Esther Way	City of Fresno	36.75877778	-119.82183330			X							2/11/10	15:06:32	66.1	99.5	37.1	72.1	72.4	LDL 820	RM
LT-141	1286 N. Esther Way	City of Fresno	36.76075000	-119.82341670			X							2/11/10	15:19:03	60.1	89.9	40.5	66.3	66.5	LDL 820	BV
LT-142	1941 N. Golden State Hwy	City of Fresno	36.76788889	-119.83355560	X		X						Arcade Trailer Park	2/11/10	13:50:11	67.8	100.8	37.5	73.2	73.5	LDL 820	RM
LT-143	1647 W. Normal Ave.	City of Fresno	36.76711111	-119.83111110	X		X							2/11/10	14:41:17	65.4	98.1	43.4	71.6	72.0	LDL 820	BV
LT-144	1415 W. McKinley Ave.	City of Fresno	36.76436111	-119.82827780	X	X	X							2/11/10	16:08:17	71.2	104.4	42.8	77.3	77.4	LDL 820	RM
LT-145	18455 Driver Road	City of Shafter	35.48108333	-119.20655560									Ambient	2/15/10	10:16:45	52.9	85.4	31.2	57.2	57.3	LDL 820	BV
LT-146	16455 N. Shafter Ave.	City of Shafter	35.55269444	-119.27769440			X						Ambient	2/15/10	10:55:09	50.7	79.5	33.7	55.3	55.5	LDL 820	RM
LT-147	2502 Zachary Ave.	City of Shafter	35.46322222	-119.18119440			X						Ambient	2/15/10	11:27:37	51.9	81.9	27.1	57.8	57.8	LDL 820	BV
LT-148	Unnamed Road - Between Gromer Ave and McCombs Ave, Wasco	City of Wasco	35.61144444	-119.32236110			X							2/15/10	09:28:41	56.9	94.5	30.6	61.4	61.4	LDL 820	RM
LT-149	Corner of 6th Street and Root Ave, Wasco	City of Wasco	35.59550000	-119.31291670			X						Ambient	2/15/10	09:43:24	49.3	79.1	27.6	55.1	55.2	LDL 820	BV
LT-150	1636 Broadway St.	City of Fresno	36.73988889	-119.79822220			X							2/17/10	09:38:48	58.7	86.8	41.7	61.0	61.6	LDL 820	RM
LT-151	517 N. Farris Ave.	City of Fresno	36.75097222	-119.81216670			X							2/17/10	10:03:02	63.1	97.0	46.2	67.5	67.8	LDL 820	BV
LT-152	1503 C Street, Fresno	City of Fresno	36.73311111	-119.80397220			X							2/17/10	09:22:13	60.9	98.7	29.1	64.2	64.7	LDL 820	RM
LT-153	635 Fresno Street @ Pottle	City of Fresno	36.72663889	-119.80569440			X							2/17/10	09:43:08	61.8	88.5	37.6	64.5	65.1	LDL 820	BV
LT-154	1127 Tulare St., Fresno	City of Fresno	36.72822222	-119.79838890			X							2/17/10	10:04:01	60.6	94.8	47.1	64.6	65.1	LDL 820	RM
LT-155	1105 Kern Street, Fresno	City of Fresno	36.72702778	-119.79755560			X							2/17/10	10:32:29	58.5	86.0	44.8	62.8	63.5	LDL 820	BV
LT-156	248 N. Van Ness Ave., Fresno	City of Fresno	36.74683333	-119.79863890			X			X				2/18/10	09:49:45	58.2	83.7	32.5	60.9	61.5	LDL 820	RM
LT-157	310 N. Fulton Street @ Mildreda Ave., Fresno	City of Fresno	36.74761111	-119.80011110			X			X				2/18/10	11:06:32	62.8	95.2	37.7	66.4	66.8	LDL 820	BV
LT-158	405 N. Effie Street	City of Fresno	36.74875000	-119.78847220			X	X				X		2/18/10	10:36:56	62.0	88.6	36.9	67.1	67.8	LDL 820	RM
LT-159	415 Dolores Street	City of Bakersfield	35.37236111	-118.99855560	X		X							2/22/10	09:02:25	56.9	82.7	33.9	63.1	63.4	LDL 820	BV
LT-160	725 Eureka Street	City of Bakersfield	35.37230556	-118.99308330			X							2/22/10	09:24:37	54.1	76.3	38.1	59.4	59.6	LDL 820	RM
LT-161	1306 E. 19th Ave	City of Bakersfield	35.37288889	-118.98380560	X		X			X				2/22/10	09:49:57	63.9	94.9	38.5	68.3	68.5	LDL 820	BV
LT-162	1430 Eureka	City of Bakersfield	35.37019444	-118.98205560	X		X							2/23/10	09:08:06	55.3	91.2	33.6	58.1	58.5	LDL 820	RM
LT-163	1054 Washington Street	City of Bakersfield	35.36788889	-118.97700000	X		X						Govea Gardens Apartments	2/23/10	09:48:41	58.5	92.7	32.1	66.1	66.3	LDL 820	BV
LT-164	827 Chico Street @ Beale Ave	City of Bakersfield	35.36975000	-118.99244440			X							2/23/10	10:35:14	60.2	97.0	35.9	61.8	63.9	LDL 820	RM

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-165	1414 11th Street	City of Bakersfield	35.36788889	-118.98947220	X		X							2/23/10	11:06:53	61.6	89.8	36.7	63.2	64.0	LDL 820	BV
LT-166	2126 Larcus Street	City of Bakersfield	35.36761111	-118.96852780			X							2/23/10	11:24:34	59.1	92.7	35.8	61.0	61.3	LDL 820	RM
LT-167	1106 Quantico Street	City of Bakersfield	35.36752778	-118.95919440	X		X							2/24/10	12:25:30	54.1	84.4	32.6	59.1	59.6	LDL 820	BV
LT-168	2900 Citrus Ave	City of Bakersfield	35.36736111	-118.95516670	X		X						Landscaping	2/24/10	12:41:36	57.2	81.7	32.0	61.2	61.6	LDL 820	RM
LT-169	2001 Kentucky Street	City of Bakersfield	35.37338889	-118.97222220	X		X							2/24/10	13:05:48	60.9	88.1	39.3	66.3	66.9	LDL 820	BV
LT-170	2333 Center Street, Unit B	City of Bakersfield	35.37163889	-118.96536110	X		X							2/24/10	13:17:35	58.2	91.2	34.8	63.5	64.1	LDL 820	RM
LT-171	2619 Trust Street	City of Bakersfield	35.37005556	-118.95991670	X		X							2/24/10	13:30:41	59.0	95.3	30.7	62.5	63.0	LDL 820	BV
LT-172	2903 Pioneer Dr. (Edison Village)	City of Bakersfield	35.36813889	-118.95233330	X		X			X				2/25/10	14:12:59	52.9	80.2	36.0	57.4	57.8	LDL 820	RM
LT-173	721 Oswell Street (Black & White Mobil Home Lodge)	City of Bakersfield	35.36747222	-118.94966670	X		X							2/25/10	14:34:49	64.3	91.4	41.1	71.1	71.2	LDL 820	BV
LT-174	3309 Camellia Street	City of Bakersfield	35.36597222	-118.94433330	X		X							2/25/10	14:56:16	63.3	90.3	37.7	70.2	70.4	LDL 820	RM
LT-175	301 Cooley Drive	City of Bakersfield	35.36402778	-118.93466670	X		X							2/25/10	15:07:40	65.9	98.2	42.4	72.3	72.4	LDL 820	BV
LT-176	6601 Eucalyptus Drive	City of Bakersfield	35.36272222	-118.92711110	X		X						Cement wall between instrument and tracks	2/25/10	15:24:30	55.0	86.0	38.9	60.4	60.6	LDL 820	RM
LT-177	706 Zinara St.	City of Bakersfield	35.36741667	-118.94955560	X									3/1/10	09:15:27	65.6	96.1	35.2	67.4	67.6	LDL 820	BV
LT-178	4312 Deacon	City of Bakersfield	35.36216667	-118.93483330			X			X				3/1/10	09:30:55	56.7	94.2	37.0	61.1	61.7	LDL 820	RM
LT-179	250 Fairfax Road (Bakersfield Palms RV Resort)	City of Bakersfield	35.36166667	-118.92938890	X		X						Cement wall between instrument and tracks	3/1/10	09:51:34	60.0	83.3	39.6	66.6	67.0	LDL 820	BV
LT-180	7749 Mills Drive	City of Bakersfield	35.36127778	-118.91736110	X		X					X	Ambient; Road Construction	3/1/10	10:16:04	58.3	89.5	34.6	64.6	65.2	LDL 820	RM
LT-181	426 Monica Street	City of Bakersfield	35.35850000	-118.90566670	X									3/1/10	10:28:43	58.9	86.7	34.9	65.8	66.2	LDL 820	BV
LT-182	8633 E. Brundage Lane, 93307	City of Bakersfield	35.35425000	-118.90841670	X		X							3/2/10	10:24:38	63.3	92.0	42.5	68.1	68.4	LDL 820	RM
LT-183	9307 Brillow Drive	City of Bakersfield	35.35813889	-118.90088890	X		X							3/2/10	10:41:03	57.6	94.5	35.0	61.7	62.2	LDL 820	BV
LT-184	355 S. Vineland Road	City of Bakersfield	35.35186111	-118.89605560	X	X	X							3/2/10	11:15:30	58.8	88.5	42.3	66.0	66.2	LDL 820	RM
LT-185	963 Buna Lane	City of Bakersfield	35.34638889	-118.87619440	X		X							3/2/10	11:36:14	59.7	87.2	39.0	65.9	66.3	LDL 820	BV
LT-186	12252 Atlantic Street	City of Bakersfield	35.34550000	-118.86791670	X		X							3/2/10	11:48:09	59.0	91.2	38.7	65.6	65.9	LDL 820	RM
LT-187	1660 Pine Street @ Truxton Ave	City of Bakersfield	35.37363889	-119.03141670	X		X							3/3/10	12:40:39	62.7	95.4	42.0	66.8	67.1	LDL 820	BV
LT-188	2009 California Street	City of Bakersfield	35.36816667	-119.02455560			X				X			3/3/10	12:55:32	67.1	92.0	44.7	69.7	70.1	LDL 820	RM
LT-189	701 Oleander Avenue	City of Bakersfield	35.36397222	-119.02591670			X							3/3/10	13:13:41	59.2	88.5	37.9	60.5	60.7	LDL 820	BV
LT-190	301 A Street @ 3rd Street	City of Bakersfield	35.35911111	-119.02955560			X							3/3/10	13:33:03	59.6	91.6	38.2	62.3	62.9	LDL 820	RM
LT-191	1621 6th Street	City of Bakersfield	35.36200000	-119.02102780			X							3/4/10	14:21:00	65.7	97.5	35.2	68.6	69.0	LDL 820	BV
LT-192	1015 O Street (Corner of N and 11th)	City of Bakersfield	35.36747222	-119.01452780			X			X				3/4/10	14:36:52	62.9	95.1	40.4	63.8	63.9	LDL 820	RM
LT-193	906 3rd Street (Corner of P and 3rd)	City of Bakersfield	35.35925000	-119.01202780			X			X				3/4/10	14:45:50	66.3	96.9	43.1	69.0	70.0	LDL 820	BV

Table D-2
Long-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Data Information								
			Coordinates		Noise Sources																	
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	24-Hour L_{eq}	L_{max}	L_{min}	L_{dn}	CNEL	Instrumentation	Eng / Tech
LT-194	200 Texas Street (Corner of Texas and King)	City of Bakersfield	35.35783333	-118.99416670			X			X				3/4/10	14:57:51	60.6	85.4	40.8	64.6	64.9	LDL 820	RM
LT-195	2717 Q Street	City of Bakersfield	35.38477778	-119.01086110			X							- -	- -	- -	- -	- -	- -	- -	- -	- -
LT-196	n/a	- -	- -	- -										- -	- -	- -	- -	- -	- -	- -	- -	- -
LT-197	2311 19th Street	City of Bakersfield	35.37608333	-119.02861110			X					X		3/8/10	08:58:21	63.6	92.6	39.6	67.8	67.9	LDL 820	BV
LT-198	2323 Spruce	City of Bakersfield	35.38086111	-119.03308330			X							3/8/10	09:09:17	69.1	95.1	33.2	71.3	72.3	LDL 820	RM
LT-199	2330 21st Street	City of Bakersfield	35.37836111	-119.02902780			X							3/8/10	09:21:33	63.7	95.1	36.8	65.9	66.2	LDL 820	BV
LT-200	528 Monterey	City of Bakersfield	35.38163889	-118.99333330			X							3/8/10	09:44:35	61.7	99.4	36.2	63.8	64.3	LDL 820	RM

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-1	Bakersfield High School (14th and F Street)	City of Bakersfield	35.37066667	-119.0236944	X		X	X			X	X	Train @ 11:45, 12:45	10/26/09	11:46:10	12:46:13	59.5	69.1	B&K 2236	RM
ST-2	2215 Truxton Ave.	City of Bakersfield	35.37230556	-119.0279722	X		X	X					Fan/Exhaust system for Hospital humming; Locomotives moving around; Air brakes in train yard	10/26/09	11:46:10	12:46:13	77.8	79.9	B&K 2231	BV
ST-3	Intersection of Myrtle and California	City of Bakersfield	35.36841667	-119.0340000			X			X		X	Traffic, dogs barking	10/26/09	14:49:02	15:49:02	71.4	72.1	LDL 820	RM
ST-4	Jastro Park	City of Bakersfield	35.37361111	-119.0340833			X			X			Intersection of Myrtle and Truxtun	10/26/09	14:49:02	15:49:02	68.7	71.2	LDL 820	BV
ST-5	Beale Memorial Library (701 Truxtun Ave)	City of Bakersfield	35.37227778	-119.0103056	X		X					X	Amtrak Station on South Side	10/27/09	10:00:42	11:00:44	57.8	67.7	LDL 820	RM
ST-6	Franklin Elementary School (2400 Truxton Ave)	City of Bakersfield	35.37372222	-119.0296111	X		X	X		X				10/27/09	10:00:42	11:00:44	65.0	68.8	LDL 820	BV
ST-7	1109 Harvest Creek	City of Bakersfield	35.36844444	-119.1011667			X	X		X		X	Distant Landscaping @ 12:40 and 4-wheelers @ 12:20	10/27/09	12:00:02	13:00:09	64.9	69.0	LDL 820	RM
ST-8	8600 Lyn River	City of Bakersfield	35.36861111	-119.0978333			X	X		X			Across street from Medical Building	10/27/09	12:00:02	13:00:09	67.4	71.4	LDL 820	BV
ST-9	Jewetta Ave (Suncrest RV Park)	City of Bakersfield	35.38280556	-119.1280833	X		X			X			Train @ 15:53, 15:58	10/27/09	15:40:06	16:40:07	59.8	64.2	LDL 820	RM
ST-10	2050 Verdugo Lane	City of Bakersfield	35.37836111	-119.1191389	X		X			X		X	Train EB, Train WB	10/27/09	15:40:06	16:40:07	57.0	68.8	LDL 820	BV
ST-11	2001 Dean Ave	City of Bakersfield	35.37758333	-119.1171389	X		X			X		X	Nearby Landscaping; Train @ 10:53, 11:30	10/28/09	10:40:01	11:40:09	55.3	54.3	LDL 820	RM
ST-12	3209 Nebula Court	City of Bakersfield	35.38930556	-119.1343611	X			X		X		X	Nearby Fountain and Chimes; Train @ 10:41, 11:15	10/29/09	10:30:03	11:30:45	58.5	59.5	LDL 820	RM
ST-13	4408 Allen Road	City of Bakersfield	35.39980556	-119.1453333	X	X	X			X		X	Multiple train horns	10/29/09	10:30:03	11:30:45	74.7	75.7	LDL 820	BV
ST-14a	14527 Palm Ave	City of Bakersfield	35.40841667	-119.1636667	X	X	X	X		X			Train @ 12:55	10/29/09	12:20:03	13:22:05	53.4	65.9	B&K 2236	RM
ST-14b	14527 Palm Ave	City of Bakersfield	35.40841667	-119.1636667	X	X	X	X		X			Nearby tractor; train horn @ 12:10	11/2/09	11:50:06	12:50:10	49.0	64.1	B&K 2236	RM
ST-15	13017 Hageman Frontage Road	City of Bakersfield	35.39791667	-119.1473056			X	X		X		X	Nursery	10/29/09	12:20:03	13:22:05	65.8	78.4	B&K 2231	BV
ST-16	Frontier High School (6401 Allen Road)	City of Bakersfield	35.41822222	-119.1520000	X	X	X	X			X		Behind High School Bleachers; Train horn	11/2/09	11:50:06	12:50:10	43.8	58.9	B&K 2231	BV
ST-17	Pentecostal Church of God +house (32186 7th Standard)	City of Bakersfield	35.44191667	-119.1996111	X	X	X			X				11/2/09	14:30:03	15:30:06	66.6	78.1	B&K 2236	RM
ST-18	19441 Santa Fe Rd.	City of Bakersfield	35.44538889	-119.2038056	X	X	X			X			Train horns, car horns	11/2/09	14:30:03	15:30:06	71.6	83	B&K 2231	BV
ST-19	31363 Orange St.	City of Shafter	35.47800000	-119.2375833	X	X				X		X	Train horns @ 11:32, 11:50, 12:00	11/3/09	11:30:02	12:30:05	46.7	61.2	B&K 2236	RM
ST-20	18631 Santa Fe Rd.	City of Shafter	35.47291667	-119.2386111	X	X	X			X		X	SB AMTRAK 1/4; vehicle traffic	11/3/09	11:30:02	12:30:05	52.8	67.3	B&K 2231	BV
ST-21	1240 Los Angeles Ave.	City of Shafter	35.49241667	-119.2563889	X	X	X			X			Landscaping; Train @ 13:40, 14:00	11/3/09	13:30:02	14:30:06	67.0	65.8	B&K 2236	RM
ST-22	455 E. Ash Ave.	City of Shafter	35.49611111	-119.2695556	X	X	X			X			NB AMTRAK 1/4; Freight train 2/70+; SB Freight 3/65/3	11/3/09	13:30:02	14:30:06	58.0	66.7	B&K 2231	BV
ST-23	511 Jackson Ave.	City of Shafter	35.50155556	-119.2705000	X	X	X				X		Train @ 15:37 - 4 locomotives	11/3/09	15:10:02	16:10:45	68.3	69.6	B&K 2236	RM
ST-24	Shafter High School (526 Mannel Ave.)	City of Shafter	35.50719444	-119.2691667	X	X	X				X		Multiple train horns	11/3/09	15:10:02	16:10:45	60.2	68.3	B&K 2231	BV
ST-25	29600 Kimberlina Road	City of Wasco	35.55294444	-119.3131667	X	X				X			AMTRAK train horn @ 13:44	11/4/09	13:10:00	14:10:10	42.5	48.2	B&K 2236	RM
ST-26	29895 Merced Avenue	City of Wasco	35.52894444	-119.3062778	X	X	X			X			Southeast Corner of Merced and Highway 43	11/4/09	13:10:00	14:10:10	72.0	72.7	B&K 2231	BV
ST-27	715 Mayer Lane	City of Wasco	35.51636111	-119.2913333	X	X	X			X	X	X		11/4/09	15:30:02	16:30:35	68.1	72.5	B&K 2236	RM
ST-28	Redwood Elementary School (331 Shafter Ave)	City of Wasco	35.50427778	-119.2783333	X	X	X						Train @ 10:24 (AMTRAK - 1 locomotive)	11/5/09	9:40:01	10:40:04	64.2	70.7	B&K 2236	RM

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-29	397 Fresno Avenue	City of Wasco	35.51430556	-119.2806667			X	X				X		11/5/09	9:40:01	10:40:04	58.0	64.4	B&K 2231	BV
ST-30	Prospect and Hwy 43	City of Wasco	35.56622222	-119.3327500	X	X	X						Train @ 2:30pm	11/5/09	14:20:30	15:20:32	63.6	69	B&K 2236	RM
ST-31	Kimberlina Road	City of Wasco	35.55825000	-119.3270833	X		X					X	Freight Train 3/73/2	11/5/09	14:20:30	15:20:32	63.3	68.7	B&K 2231	BV
ST-32	Theresa Burke Elementary School (Filburn and Griffith, Wasco)	City of Wasco	35.57941667	-119.3406389	X		X	X		X	X		Ambient	11/6/09	9:20:03	10:20:05	56.2	61.8	B&K 2236	RM
ST-33	15848 Griffith Ave	City of Wasco	35.57561111	-119.3396667	X		X	X		X	X	X	Train NB 6/70 & train SB 2/60	11/6/09	9:20:03	10:20:05	42.7	48.2	B&K 2231	BV
ST-34	4th Street @ F Street	City of Wasco	35.59794444	-119.3338889	X		X	X	X		X		Trains passed @ 11:25, 11:37-11:38, 11:45, 12:15; Steady low hum from auto shop ventilation across street	11/11/09	11:20:14	12:20:24	69.0	70.9	B&K 2231	BV
ST-35	Wasco Child Development Center (764 H Street)	City of Wasco	35.59322222	-119.3309722	X	X	X						Freight train SB 4/<60, NB 4/60, SB 2 engines, NB freight 4/60	11/11/09	11:20:14	12:20:24	67.4	69.3	B&K 2231	BV
ST-36	St. Johns School (9th Street @ Broadway)	City of Wasco	35.59152778	-119.3382778	X		X			X	X	X	Landscaping - chainsaw started at 14:55pm	11/11/09	14:00:16	15:00:22	60.6	66.7	B&K 2236	PM
ST-37	Filburn Ave	City of Wasco	35.57972222	-119.3263333	X		X			X		X	Ambient; location quiet - dogs barking at first, train horn 54+dBA	11/11/09	14:00:16	15:00:22	38.1	57.8[1]	B&K 2231	BV
ST-38	Karl F. Clemens Middle School (5th Street @ Broadway)	City of Wasco	35.59697222	-119.3382778	X		X	X		X	X	X	Loud train horn sounded @ 15:34, 15:38-15:40, 16:24	11/11/09	15:30:13	16:23:34	63.3	67.4	B&K 2236	PM
ST-39	Thomas Jefferson Middle School (Griffith @ 1st Street)	City of Wasco	35.60044444	-119.3406111	X		X				X	X	Lots of traffic noise, Kids jumping over chain link fence and yelling	11/11/09	15:30:13	16:23:34	57.9	63	B&K 2231	BV
ST-40	Gromer Avenue @ Annin Street	City of Wasco	35.60877778	-119.3357778	X	X	X			X		X	Hydroseeding generator audible across the street @ 9:00-9:02, 9:25-9:28, 9:41, 9:56; Laborers have music playing 9:14-9:25; Train passed location @ 9:16, 9:37, 9:58	11/12/09	9:00:12	10:00:29	60.4	65.6	B&K 2236	PM
ST-41	Hwy 43 @ Taussig Ave	City of Wasco	35.65225000	-119.3318333	X		X					X	AMTRAK passes 13:53	11/12/09	13:29:59	14:32:13	64.9	72.4	B&K 2250	TL
ST-42	28994 Taussig Ave	City of Wasco	35.65241667	-119.3398889			X	X		X			Roadway getting wet from light showers	11/12/09	13:31:13	14:31:40	62.2	69.6	B&K 2236	BV
ST-43	28998 Blakenship Avenue	City of Wasco	35.66711111	-119.3392778	X							X	Ambient; machinery in adjacent field, BNSF 15:10, 15:31, 15:33	11/12/09	14:50:10	15:51:23	49.5	55	B&K 2250	TL
ST-44	29398 Blankenship Avenue	City of Wasco	35.66694444	-119.3224167	X		X			X				11/12/09	14:50:49	15:51:00	49.8	55.4	B&K 2236	BV
ST-45	29370 Peterson Road	City of Wasco	35.70313889	-119.3218889	X		X			X		X	Car passed by @ 11:50, 11:51, 11:55, 12:00, 12:02, 2:12:09, 12:20, 12:23, 12:38, 12:37; Distant train horn @12:31	11/16/09	11:50:11	12:50:14	60.2	65.7	B&K 2236	GD
ST-46	29380 Elmo near Hwy 43	City of Wasco	35.68875000	-119.3216944			X						Tractors idling	11/16/09	11:50:11	12:50:14	55.5	66.9	B&K 2231	BV
ST-47	29160 Pond Road	City of Wasco	35.72177778	-119.3321667	X		X					X	Trains pass @ 15:21, 15:59	11/16/09	15:00:11	16:02:12	69.0	69.9	B&K 2236	GD
ST-48	11815 Pond Road, Wasco	City of Wasco	35.72294444	-119.3301111	X		X				X	X	AMTRAK 1/4	11/16/09	15:00:11	16:02:12	58.3	64.9	B&K 2231	BV
ST-49	31793 Riverside Street	City of Shafter	35.48500000	-119.2162778			X	X		X		X	Four wheeler and truck passed @ 14:34; Plane overhead and tractor in distance @ 14:37	11/17/09	14:30:07	15:30:11	53.6	45.4	B&K 2236	GD
ST-50	18455 Driver Road	City of Shafter	35.48150000	-119.2064722			X	X		X		X	Lots of animal noise from farm; airport landing path	11/17/09	14:30:07	15:30:11	55.5	47.3	B&K 2231	BV
ST-51	Fresno Ave	City of Shafter	35.51436111	-119.2666667	X		X			X	X		Children playing basketball 11yrds NW; Large school bus @ 14:54; Lawnmower in distance @ ~14:53	11/18/09	14:50:06	15:50:07	59.7	66	B&K 2236	GD

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-52	Field @ corner of Beech & Canal	City of Shafter	35.50952778	-119.2635278	X		X			X	X		School busses, train horn, soccer kids running by	11/18/09	14:50:06	15:50:07	43.9	50.1	B&K 2231	BV
ST-53	30998 Fresno Ave.	City of Shafter	35.51433333	-119.2515000	X			X		X		X	Distant Music; Walkers (talking) passed @ 9:29; Aircraft overhead throughout; Large machine (possibly a tractor) started ~10:10	11/19/09	9:20:05	10:20:06	56.5	61.3	B&K 2236	GD
ST-54	1740 Beech Ave.	City of Shafter	35.52102778	-119.2603333			X	X		X		X	Low flying plane over crops; Thunderous booms (hammering) from nearby warehouse	11/19/09	9:20:05	10:20:06	61.6	66.4	B&K 2231	BV
ST-55	350 Pine Street	City of Shafter	35.50505556	-119.2625278	X		X			X		X	Landscaping	11/19/09	10:40:13	11:40:14	55.4	62.1	B&K 2236	GD
ST-56	1190 Weyand Way @ State Street	City of Shafter	35.50333333	-119.2571667	X			X				X	Train horns in distance; low flying planes; dogs constantly barking	11/19/09	10:40:13	11:40:14	73.3	62.1	B&K 2231	BV
ST-57	31145 Fresno Ave.	City of Shafter	35.51438889	-119.2476389	X		X	X						11/19/09	12:05:07	12:39:09	52.3	62.1	B&K 2236	GD
ST-58	17431 Mannel Avenue	City of Shafter	35.51875000	-119.2683889			X			X		X	Truck pulled up to meter @ 16:50 for ~1 minute	11/19/09	16:00:05	16:26:55	52.7	62.1	B&K 2236	GD
ST-59	Mannel Avenue	City of Shafter	35.52236111	-119.2691389	X		X		X	X		X	Constant generator noise from Oil Derek	11/19/09	16:00:05	16:26:55	54.7	64.1	B&K 2231	BV
ST-60	Shafter Avenue	City of Shafter	35.52677778	-119.2779722	X		X			X		X		11/20/09	9:50:57	10:50:57	57.1	57.5	B&K 2236	GD
ST-61	17413 Mettler	City of Shafter	35.52100000	-119.2870278	X		X	X				X	Train horns in distance	11/20/09	9:50:57	10:50:57	52.4	52.8	B&K 2231	BV
ST-62	155 Redwood Drive	City of Shafter	35.51066667	-119.2770556			X	X					Gentleman came by to discuss recording @ 11:33	11/21/09	11:10:00	12:10:00	54.8	61.3	B&K 2236	GD
ST-63	100 Walker Street (Behind Shafter Museum)	City of Shafter	35.50627778	-119.2763333	X		X					X	NB Freight train 4/60+ as well as train horns	11/22/09	11:10:00	12:10:00	67.7	74.1	B&K 2231	BV
ST-64	Merced Avenue	City of Shafter	35.52925000	-119.2673056			X						Rustling leaves	11/23/09	13:40:00	14:40:00	63.6	65.6	B&K 2236	GD
ST-65	Unknown	City of Shafter	35.51441667	-119.2755000			X				X		Rustling leaves and a lot of vehicle traffic	11/20/09	13:40:00	14:40:00	64.8	58.6	B&K 2231	BV
ST-66	17052 Shafter Avenue	City of Shafter	35.53233333	-119.2733333	X		X			X			rustling leaves	11/30/09	11:49:54	12:49:55	45.0	51.4	B&K 2236	GD
ST-67	Merced Avenue	City of Shafter	35.52913889	-119.2755833	X		X			X		X	Train horn in the distance	11/30/09	11:49:54	12:49:55	55.3	61.7	B&K 2231	BV
ST-68	30345 Merced Avenue	City of Shafter	35.52905556	-119.2830556			X						Large truck passed @ 13:57	11/30/09	13:50:11	14:50:29	60.8	59.1	B&K 2236	GD
ST-69	Merced Avenue	City of Shafter	35.52902778	-119.2891389			X	X		X		X		11/30/09	13:50:11	14:50:29	60.2	66.6	B&K 2231	BV
ST-70	30749 Merced	City of Shafter	35.52913889	-119.2648333						X			Ambient	11/30/09	14:59:11	16:00:44	59.1	65.9	B&K 2236	GD
ST-71	29140 Schuster Road	City of Shafter	35.75250000	-119.3385833	X		X			X			Train passed @ 13:55	12/1/09	13:49:52	14:49:54	47.7	66.7[1]	B&K 2236	GD
ST-72	Schuster Road	City of Wasco	35.73227778	-119.3380000	X		X					X		12/1/09	13:49:52	14:49:54	60.2	65.4	B&K 2231	BV
ST-73	11242 Hwy 43	City of Wasco	35.73961111	-119.3375556			X				X		School bus stopped near meter @ 15:15	12/1/09	15:09:55	16:10:07	68.1	72.2	B&K 2236	GD
ST-74	Schuster Road	City of Wasco	35.73230556	-119.3333056			X							12/1/09	15:09:55	16:10:07	62.9	66.9	B&K 2231	BV
ST-75	28994 Garces Hwy	City of Wasco	35.76116667	-119.3393056	X		X			X				12/2/09	9:59:53	10:59:55	69.1	65.3	B&K 2236	GD
ST-76	28820 Garces Hwy	City of Wasco	35.76127778	-119.3547500	X		X					X	Constant generator noise	12/2/09	9:59:53	10:59:55	65.9	61.5	B&K 2231	BV
ST-77	2990 Road 84	Earlimart	35.84441667	-119.3820556			X	X		X	X	X	Children walked by and talked to tester @ 15:53; Kids began to play @ 16:07	12/2/09	15:39:54	16:39:54	49.0	51.3	B&K 2236	GD
ST-78	8830 Avenue 24	Earlimart	35.83377778	-119.3736944	X	X	X					X	AMTRAK NB passed location	12/2/09	15:39:54	16:39:54	63.2	65.6	B&K 2231	BV

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Measurement Site Information					Measurement Source Information									Measurement Information						
			Coordinates		Noise Sources															
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-79	Avenue 32	Earlimart	35.84816667	-119.3808611			X	X				X	Dogs barked @ 9:52; Loud aircraft in distance @ 10:06; Dogs barked @ 10:08-10:10	12/3/09	9:41:23	10:42:28	47.4	68.7[1]	B&K 2236	GD
ST-80	3442 Road 84	Earlimart	35.85250000	-119.3843333	X		X					X	Rooster crowing in distance	12/3/09	9:41:23	10:42:28	53.7	64.5	B&K 2231	BV
ST-81	4011 Road 84	Earlimart	35.86091667	-119.3845556	X	X	X		X					12/3/09	10:49:53	11:49:54	64.4	71.2	B&K 2236	GD
ST-82	3764 Road 84	Earlimart	35.85819444	-119.3829167	X		X			X			Heavy trucks on Hwy 43; AMTRAK SB, Slow Freight NB; Fast freight train SB	12/3/09	10:49:53	11:49:54	58.4	65.1	B&K 2231	BV
ST-83a	Avenue 108	City of Corcoran	35.98544444	-119.4668611	X		X			X		X	Heavy machinery operating @ 12:54-13:04; Vehicle traffic a2 12:13, 12:21, 12:30, 12:42, 12:53; Train passed @ 12:57	12/4/09	11:49:49	12:50:01	52.5	57.4	B&K 2236	GD
ST-83b	Avenue 108	City of Corcoran	35.98544444	-119.4668611	X		X					X	Tractor working in field moved closer and is much louder @ 15:35	12/4/09	14:41:43	15:41:43	53.4	62.4	B&K 2236	GD
ST-84	11200 Hwy 43 @ Ave 112	City of Corcoran	35.99280556	-119.4693333	X	X	X	X				X	Birds; Winds in the trees; Tractor; Aircraft; AMTRAK EB @ 15:07 4/1; BNSF EB @ 15:17 3/47/0; BNSF Freight EB @ 15:26 4/48/0	12/4/09	14:40:00	15:40:00	47.8	62.4	B&K 2250	TL
ST-85	28794 Shuster Ave, Wasco	City of Wasco	35.73236111	-119.3480000			X			X		X	Saw running intermittently @ residence	12/14/09	13:20:00	14:20:00	53.8	59.8	B&K 2236	RM
ST-86	Schuster Road near Palm Ave	City of Wasco	35.73408333	-119.3433611	X		X					X	Small dog barking; AMTRAK train passing at 14:01; Car leaving @ 14:12	12/14/09	13:20:00	14:20:00	41.8	60.9	B&K 2231	BV
ST-87	28384 Garces Hwy	City of Wasco	35.76122222	-119.3670833			X					X		12/14/09	15:00:00	16:00:00	65.3	70.3	B&K 2236	RM
ST-88	11237 Magnolia Ave.	City of Wasco	35.74430556	-119.3659167			X		X		X	X	Field pump is on since 15:00; ATV passed @ 3:08; School bus drop-off @ 3:39; Cars and Trucks passing by @ 14:16, 15:53	12/14/09	15:00:00	16:00:00	58.6	63.5	B&K 2231	BV
ST-89	3141 Avenue 36	Earlimart	36.03630556	-119.5023889	X	X	X					X	Distant trains and vehicles	12/15/09	14:30:01	15:30:01	41.4	59.5	B&K 2236	RM
ST-90	14942 Hwy 43	City of Corcoran	36.06069444	-119.5278889	X		X	X					Heavy trucks @ 14:40, 14:44, 14:46; Freight train 14:52-14:53; Planes overhead @ 15:00, 15:18	12/15/09	14:30:01	15:30:01	60.7	68.2	B&K 2231	BV
ST-91	710 Hanna Avenue	City of Corcoran	36.09961111	-119.5564722	X		X			X		X	Train passed @ 15:00	12/16/09	14:40:01	15:40:01	61.2	69.9	B&K 2236	RM
ST-92	747 Hall Avenue	City of Corcoran	36.09525000	-119.5566944	X		X		X			X	Heavy traffic in area; Radio playing loud; generator started running @ 14:55; Trains passing @ 14:40 - AMTRAK NB, 15:04 AMTRAK SB	12/16/09	14:40:01	15:40:01	59.8	59.8	B&K 2231	BV
ST-93	1000 Paterson	City of Corcoran	36.10158333	-119.5600556	X		X							12/17/09	9:50:02	10:50:02	70.0	78.4	B&K 2236	RM
ST-94	614 Otis (Kings Mobile Lodge)	City of Corcoran	36.10461111	-119.5619167	X		X					X	Heavy Trucks passed @ 10:04, 10:09, 10:41; Train horn sounded @ 10:14; 2 Locomotives passed @ 10:15	12/17/09	9:50:02	10:50:02	70.3	78.4	B&K 2231	BV
ST-95	Hale Street @ North Avenue	City of Corcoran	36.10522222	-119.5655000			X					X		12/17/09	11:01:53	11:41:53	60.7	62	B&K 2236	RM
ST-96	6269 Newark Road	City of Corcoran	36.11980556	-119.5768611	X		X					X	Train passed @ 10:31; dogs barking @ 10:44	12/18/09	10:10:13	11:10:13	49.3	61.6	B&K 2236	RM
ST-97	320 Otis Avenue	City of Corcoran	36.10950000	-119.5660833	X	X	X			X		X	SB Freight train stopped at intersection and idling @ 10:15, airbrakes; SB Train @ 10:45	12/18/09	10:10:13	11:10:13	64.5	76.8	B&K 2231	BV

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-98	23756 5th Avenue	City of Corcoran	36.12669444	-119.5542778			X					X	Ambient; ATV passed location @ 14:00-14:05; Cars passed @ 14:20	1/4/10	14:00:01	15:00:04	59.4	62.6	B&K 2236	RM
ST-99	306 5th Avenue	City of Corcoran	36.11005556	-119.5544167	X		X			X			Train horn in the distance @ 14:25	1/4/10	14:00:01	15:00:04	54.5	57.7	B&K 2231	BV
ST-100	5th Avenue @ Niles Road	City of Corcoran	36.11600000	-119.5549722			X						Ambient	1/5/10	14:09:38	15:09:44	43.4	49.5	B&K 2236	RM
ST-101	23261 5th Avenue	City of Corcoran	36.13425000	-119.5545556	X		X	X		X		X	Ambient; Farm animals in distance; radio in distance; Cars passed location @ 11:17, 11:28, 11:31, 11:39, 12:03; Plane overhead @ 11:27; Train horn @ 12:01, 12:03, 12:04; Saw running @ 11:57, 12:04	1/6/10	11:09:50	12:10:46	46.9	47.3	B&K 2236	RM
ST-102	23340 5 1/2 Avenue	City of Corcoran	36.13166667	-119.5632778	X		X			X		X	A lot of traffic at this location	1/6/10	11:09:50	12:10:46	61.8	62.2	B&K 2231	BV
ST-103	22075 8th Avenue	City of Hanford	36.17752778	-119.5990833			X					X		1/7/10	12:29:49	13:30:27	55.7	59.4	B&K 2236	RM
ST-104	7603 Kent Avenue	City of Hanford	36.22572222	-119.5936667	X		X	X		X		X		1/8/10	14:49:51	15:50:21	54.8	60.2	B&K 2236	RM
ST-105	16299 7th Avenue	City of Hanford	36.23652778	-119.5828889	X		X	X		X			Cars passed by @ 12:39, 12:40, 12:43, 12:45, 12:49, 13:00; Motorcycle passed @ 12:50; Train Passed @ 1:03; Train Horns (4) @ 1:06	1/25/10	12:30:00	13:30:00	59.6	60.5	B&K 2236	RM
ST-106	16680 7th Avenue	City of Hanford	36.23069444	-119.5833056			X	X		X			Crop duster and multiple jets above @ 12:45, 12:56 (2 F-18's)	1/25/10	12:30:00	13:30:00	59.6	60.5	B&K 2231	BV
ST-107	12051 8th Avenue @ Hwy 43	City of Hanford	36.28897222	-119.5987500			X			X			Rain @ 13:45, 14:10 - meter was close to tarp	1/26/10	13:20:00	14:20:00	57.8	58.7	B&K 2236	RM
ST-108	13320 7th Avenue	City of Hanford	36.27911111	-119.5831944			X	X		X		X	Airplane overhead @ 9:57, 10:31; Saw running @ 10:30	1/27/10	9:40:00	10:40:00	52.2	57.2	B&K 2236	RM
ST-109	13012 7th Avenue	City of Hanford	36.28391667	-119.5834167			X	X				X	Ambient; Airplane overhead @ 9:58	1/27/10	9:40:00	10:40:00	55.2	60.2	B&K 2231	BV
ST-110	7696 Grangeville Road	City of Hanford	36.34336111	-119.5958333			X	X				X		1/28/10	10:20:00	11:20:00	52.6	59.7	B&K 2236	RM
ST-111	8229 Flint Avenue	City of Hanford	36.37147222	-119.6048889	X		X			X		X	Ambient	1/29/10	10:30:00	11:30:00	55.2	58.8	B&K 2231	BV
ST-112	7746 Fargo Ave.	City of Hanford	36.35775000	-119.5963611			X	X	X			X	Lawnmower @ 12:04	1/29/10	11:50:00	12:50:00	52.5	58	B&K 2236	RM
ST-113	7968 Fargo Ave.	City of Hanford	36.35766667	-119.6009444	X		X			X		X	Car passed location and jet above	1/29/10	11:50:00	12:50:00	51.7	56	B&K 2231	BV
ST-114	3295 10th Avenue	City of Hanford	36.42650000	-119.6361667			X						Goats	2/2/10	11:40:00	12:40:00	65.4	68	B&K 2236	RM
ST-115a	Clarkson	Selma	36.50355556	-119.7189722	X		X					X	Train horn sounded @ 14:28 (6-7 times); Train passed @ 14:54	2/3/10	14:10:00	15:10:00	58.6	59.2	B&K 2236	RM
ST-115b	16495 Minnewawa	Selma	36.49650000	-119.7104167	X		X						NB Train and SB train	2/3/10	14:10:00	15:10:00	55.4	61.9	B&K 2231	BV
ST-116	14677 South Willow Ave.	Selma	36.52236111	-119.7276667	X			X		X		X	Wind chimes active; Train passed at 11:43, 12:05	2/5/10	11:40:00	12:40:00	53.2	58.6	B&K 2236	RM
ST-117	2136 Rose Ave	Selma	36.59755556	-119.7416389	X		X	X		X		X	Residents, car starting & leaving location @ 10:42-10:43; Train horn @ 10:43; Passing Train WB 10:44:30; Dogs at residence barking occasionally; Resident car @ 10:55	2/8/10	11:40:00	12:40:00	62.6	65.3	LDL 820	CM
ST-118	Monroe Elementary School (On Chestnut)	City of Fresno	36.56400000	-119.7368333			X		X			X	Occasional traffic on non-school day ~35mph	2/8/10	10:40:00	11:40:00	58.7	64.1	B&K 2236	RM

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-119	12382 Chestnut Ave.	City of Fresno	36.55647222	-119.7367778	X		X			X			Train horn sounded - Locomotives 2 front 2 back	2/8/10	10:40:00	11:40:00	56.7	62.2	B&K 2231	BV
ST-120	8254 Cedar Ave.	City of Fresno	36.61722222	-119.7544167	X		X	X		X		X	Rural highway area	2/8/10	13:30:00	14:30:00	53.6	58.6	LDL 820	CM
ST-121	Pacific Union Elementary School (Corner of Rowell and Bowles)	City of Fresno	36.60150000	-119.7526667	X		X			X		X	Helicopter overhead; Motorcycle @ 14:20; Train @ 14:22	2/8/10	13:30:00	14:30:00	55.6	60.7	B&K 2236	RM
ST-122	2419 Manning Avenue	City of Fresno	36.60511111	-119.7472500			X			X		X	Farmer talking next to meter; Tractor, Vineyard ATV	2/8/10	13:30:00	14:30:00	63.2	70.2	B&K 2231	BV
ST-123	2189 East Morton	City of Fresno	36.64516667	-119.7512500	X		X	X				X	Train horn @ 14:54; Train passed location @ 15:33-15:36	2/9/10	14:50:00	15:50:00	65.2	60.9	B&K 2236	RM
ST-124	2120 E. American	City of Fresno	36.66961111	-119.7528333	X		X	X				X	Train horn @ 14:52, 15:29:30; Train passed with 4 locomotives @ 15:17-15:20; Train passed by slowly @ 15:36-15:40	2/9/10	14:50:00	15:50:00	64.1	66.2	FALSE	CM
ST-125	2097 Jefferson	City of Fresno	36.64869444	-119.7528056	X		X			X		X	SB and NB trains passed location	2/9/10	14:50:00	15:50:00	66.0	61.6	B&K 2231	BV
ST-126	4199 Cedar Avenue	City of Fresno	36.67430556	-119.7549722			X			X		X		2/10/10	10:30:00	11:30:00	63.6	68.9	B&K 2236	RM
ST-127	2233 Church Street	City of Fresno	36.71472222	-119.7773611	X		X	X	X				Traffic on Golden State Hwy, trash truck backup beeper, Traffic on Church Street, Train horn & Train, Aircraft	2/10/10	10:30:00	11:30:00	63.5	66.8	LDL 820	CM
ST-128	1814 H Street	City of Fresno	36.74066667	-119.8006667	X		X	X					Traffic on H Street & Amador St.; Some construction traffic; AMTRAK train horn; BNSF train horn, Helicopter	2/10/10	14:30:00	15:30:00	57.1	59.4	LDL 820	CM
ST-129	Motel Drive @ Olive Street (Roeding Park)	City of Fresno	36.75725000	-119.8216944	X		X					X	Distant trains	2/11/10	11:10:00	12:10:00	61.4	68.6	B&K 2236	RM
ST-130	704 Adeline Avenue	City of Fresno	36.75219444	-119.8139444	X		X			X		X	Circular saw started at 11:30 as well as a landscape edger	2/11/10	11:10:00	12:10:00	55.6	59.7	B&K 2231	BV
ST-131	1636 Broadway St.	City of Fresno	36.74025000	-119.7985556	X		X	X	X	X			Distant construction and train	2/11/10	13:20:00	14:20:00	59.7	63.9	B&K 2236	RM
ST-132	G Street	City of Fresno	36.72766667	-119.7910000	X				X	X			Rap music being played; Dairy plant exhaust fan	2/11/10	13:20:00	14:20:00	60.0	63.7	B&K 2231	BV
ST-133	852 Divisidero (Iron Bird Lofts)	City of Fresno	36.74305556	-119.8007778	X		X	X	X	X			Ambient; Traffic on Divisidero & Fulton; Train - up; Aircraft from FAT; Construction noise, BNSF Horn; Talking	2/11/10	10:50:00	11:50:00	55.4	60.7	LDL 820	CM
ST-134	1383 N. Golden State Blvd (Town House Motel)	City of Fresno	36.76036111	-119.8260556	X		X		X				Traffic on G.S. Blvd; Traffic on West; UP Train & Horn	2/11/10	16:00:00	17:00:00	56.2	62.3	LDL 820	CM
ST-135	1436 University Avenue	City of Fresno	36.76661111	-119.8286944			X	X	X				glass crashing @ recycling center	2/12/10	11:20:00	12:20:00	55.8	68.6	LDL 820	CM
ST-136	1631 Weldon Avenue	City of Fresno	36.76830556	-119.8309444	X		X			X		X	BNSF Horns, UP Train Horns	2/12/10	12:40:00	13:40:00	54.6	58.3	LDL 820	CM
ST-137	1224 University Avenue	City of Fresno	36.76669444	-119.8260556	X		X						UP Train and Horn	2/12/10	15:30:00	16:00:00	58.2	58.2	LDL 820	CM
ST-138	1125 West Avenue or Northwest Avenue	City of Fresno	36.75683333	-119.8269444			X			X		X	motorcycle @ 12:34, 12:50, 12:52	2/12/10	12:20:00	13:20:00	56.9	66.7	B&K 2236	RM
ST-139	Fremont Elementary School (University Avenue)	City of Fresno	36.76669444	-119.8241389	X		X			X	X		Children at recess; teachers blowing whistles; distant train horns	2/12/10	12:20:00	13:20:00	55.8	65.5	B&K 2231	BV
ST-140	530 W. Floridor Avenue	City of Fresno	36.76138889	-119.8196667	X		X			X		X		2/12/10	13:40:00	14:40:00	53.9	66.1	B&K 2231	BV
ST-141	31793 Riverside Street	City of Shafter	35.48506667	-119.2157778	X		X			X		X	BNSF Horn in distance	2/15/10	11:50:00	12:50:00	48.1	54	LDL 820	CM
ST-142	16819 N. Shafter Avenue	City of Shafter	35.54347222	-119.2779444			X		X	X			60-Hz buzz from light; oil pump motors	2/15/10	14:40:00	15:40:00	59.2	68.2	LDL 820	CM
ST-143	29577 Poso Drive	City of Shafter	35.58680556	-119.3135556	X		X	X		X		X	Amtrak Horn	2/15/10	16:10:00	17:10:00	53.0	62.4	LDL 820	CM

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-144	Bethel Temple Church (1224 Kern Street)	City of Fresno	36.72755556	-119.7965000			X	X	X			X		2/17/10	10:50:00	11:50:00	60.9	66.9	B&K 2236	RM
ST-145	Buddhist Temple (1129 Tulane)	City of Fresno	36.72861111	-119.7987778	X		X	X	X			X	Train horn 11:36; Cars running over metal plate and radio playing loudly	2/17/10	10:50:00	11:50:00	56.9	61.4	B&K 2231	BV
ST-146	La Vena's Educational Center (1015 Fresno Street)	City of Fresno	36.72930556	-119.8020000			X		X				Construction on building across street	2/17/10	13:10:00	14:10:00	68.4	71.2	B&K 2236	RM
ST-147	School ground on Stanislaus Street	City of Fresno	36.73191667	-119.8065278	X		X			X	X	X		2/17/10	13:10:00	14:10:00	58.0	59.6	B&K 2231	BV
ST-148	Park @ corner of Amador and C Street	City of Fresno	36.73675000	-119.8073889			X					X		2/17/10	14:30:00	15:30:00	60.1	61.8	B&K 2236	RM
ST-149	Glory Bound Ministries (916 Waterman @ Kern Street)	City of Fresno	36.72316667	-119.8031944	X		X	X		X		X	Traffic on Waterman and Kern; Church Bells; UP Train Horn	2/17/10	10:50:00	11:50:00	58.8	61.1	LDL 820	CM
ST-150	Boys and Girls Club (930 Tulare Street @ Mayor)	City of Fresno	36.72636111	-119.8004167	X		X	X		X		X	Lawnmower @ 13:06-13:23; Train Horn	2/17/10	13:00:00	14:00:00	57.5	59.3	LDL 820	CM
ST-151	Life Ministries (552 Tuolumne Street)	City of Fresno	36.73063889	-119.8044444	X		X	X				X	Traffic on Tuolumne, A Street, Snow Ave; F-18's; car horn	2/17/10	14:40:00	15:40:00	65.2	66.7	LDL 820	CM
ST-152	1904 E. McKenzie Ave.	City of Fresno	36.74677778	-119.7882222	X		X	X		X			Ice cream man @ 12:52; Train @ 13:04-13:05, 13:38-13:41	2/18/10	12:50:00	13:50:00	67.3	73.8	B&K 2236	RM
ST-153	472 Calaveras St.	City of Fresno	36.75002778	-119.7917500	X		X		X			X		2/18/10	12:50:00	13:50:00	59.4	65.7	B&K 2231	BV
ST-154	313 Blackstone Ave.	City of Fresno	36.74697222	-119.7909167			X			X				2/18/10	14:30:00	15:30:00	61.5	63.1	B&K 2231	BV
ST-155	1225 Divisadero Street @ Poplar Ave	City of Fresno	36.74386111	-119.7960000	X		X	X	X	X			Traffic on Divisadero St., Poplar Ave; AMTRAK horn in distance; Church bells @ 12:00; Train horn in distance	2/18/10	11:40:00	12:40:00	62.2	66.1	LDL 820	CM
ST-156	455 Broadway (Broadmont Apartments)	City of Fresno	36.74966667	-119.8031389			X	X	X				Ambient; traffic noise	2/18/10	13:49:59	14:50:04	60.8	64	LDL 820	CM
ST-157	(West of) 282 San Pablo Ave.	City of Fresno	36.74661111	-119.7945556	X		X	X		X		X	AMTRAK horn, UP Horn, Military and general aviation	2/18/10	15:20:00	16:20:00	61.4	63.5	LDL 820	CM
ST-158	1227 Miller Street	City of Bakersfield	35.37250000	-118.9845278	X		X	X		X		X	Distant sirens heard @ 11:08; aircraft overhead @ 11:14	2/22/10	10:20:00	11:20:00	62.2	70.7	B&K 2236	GD
ST-159	Bessie Owens Intermediate School (815 Eureka Street @ King Street)	City of Bakersfield	35.37175000	-118.9927778	X		X					X	Emergency vehicle sirens	2/22/10	10:20:00	11:20:00	55.0	60.4	LDL 820	ML
ST-160	400 Chico	City of Bakersfield	35.37172222	-118.9997222	X		X						Sirens, Train horn	2/22/10	10:20:00	11:20:00	56.9	62.8	B&K 2231	BV
ST-161	Alpine Street	City of Bakersfield	35.36938889	-118.9998333	X		X	X		X				2/22/10	13:29:45	14:25:17	61.7	70.4	B&K 2236	GD
ST-162	Grace Christian Center (231 Beale Avenue @ Chico)	City of Bakersfield	35.36969444	-118.9918611			X			X	X	X		2/22/10	13:30:00	14:30:00	59.3	64.8	LDL 820	ML
ST-163	Williams Street at Lake Street	City of Bakersfield	35.37705556	-118.9776389			X				X	X		2/22/10	13:30:00	14:30:00	54.6	59.6	B&K 2231	BV
ST-164	Our Lady Of Guadalupe Church (601 East California Ave)	City of Bakersfield	35.36833333	-118.9976944			X		X			X		2/23/10	13:18:38	14:19:10	67.6	73.9	B&K 2236	GD
ST-165	Martin Luther King Jr. Memorial Park; California Veteran Memorial Building (Corner of Owens Street & California Ave)	City of Bakersfield	35.36808333	-118.9912222			X		X		X	X		2/23/10	13:20:00	14:20:00	59.0	63.2	LDL 820	ML
ST-166	Church (1020 E. California Avenue)	City of Bakersfield	35.36911111	-118.9886944			X	X				X		2/23/10	13:20:00	14:20:00	59.5	63.7	B&K 2231	BV
ST-167	Mt. Vernon Elementary School (2162 Potomac Ave, Bakersfield, CA 93307)	City of Bakersfield	35.36441667	-118.9680000			X				X	X	Announcements made over loudspeaker @ 10:02, 10:03; Bell rang @ 10:15, 10:35	2/24/10	9:38:42	10:39:15	64.1	68.5	B&K 2236	GD
ST-168	Corner of Exchange Street and Steele Avenue	City of Bakersfield	35.36944444	-118.9655278	X		X					X		2/24/10	9:40:00	10:40:00	59.7	64.1	LDL 820	ML

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Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information						
			Coordinates		Noise Sources															
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-169	1241 Ogden	City of Bakersfield	35.36975000	-118.9740278			X	X				X		2/24/10	9:40:00	10:40:00	60.1	70.8	B&K 2231	BV
ST-170	Potomac Park	City of Bakersfield	35.36494444	-118.9543056	X		X			X		X	Train passed @ 15:06; Distant sirens @ 3:26	2/24/10	14:48:33	15:49:23	60.1	66.4	B&K 2236	GD
ST-171	Corner of Center Street and Tauchen Street	City of Bakersfield	35.37263889	-118.9671667	X		X					X		2/24/10	14:50:00	15:50:00	63.4	69.2	LDL 820	ML
ST-172	1008 Webster	City of Bakersfield	35.37127778	-118.9631667				X				X	Compressor started @ 15:00	2/24/10	14:50:00	15:50:00	61.6	67.4	LDL 820	BV
ST-173	2509 East California	City of Bakersfield	35.36841667	-118.9618611	X		X			X		X	Train passed location @ 10:03	2/25/10	9:49:00	10:49:19	58.4	65.4	B&K 2236	GD
ST-174	2523 Steele Street	City of Bakersfield	35.36947222	-118.9620278	X		X			X		X		2/25/10	9:50:00	10:50:00	62.7	61.3	LDL 820	ML
ST-175	Lake Street	City of Bakersfield	35.37577778	-118.9765556	X		X						Train horns	2/25/10	9:50:00	10:50:00	51.3	59.3	LDL 820	BV
ST-176	612 Descano Street	City of Bakersfield	35.36913889	-118.9544444	X		X			X	X		Trains passed location @ 10:52, 11:18, 11:35	2/26/10	10:39:25	11:39:25	59.5	61.9	B&K 2236	GD
ST-177	Ramoa Garza School (2901 Center Street)	City of Bakersfield	35.37150000	-118.9523056	X		X				X	X	Wind blew tripod holding instrument over ~5 minutes into recording	2/26/10	10:40:00	11:40:00	68.8	71.2	LDL 820	ML
ST-178	3201 Edison Hwy	City of Bakersfield	35.36616667	-118.9475278	X		X			X			Wind chimes and a lot of cars; Train passed location @ 10:52-10:55 (EB), 11:00 (WB), 11:20 (EB+WB), 11:35 (WB), 11:36 (EB)	2/26/10	10:40:00	11:40:00	72.8	75.2	LDL 820	BV
ST-179	526 Normandy Way (Corner of Normandy and Sterling)	City of Bakersfield	35.36608333	-118.9408889			X			X		X	Man across the street doing yard work with a weed-whacker @ 14:24-14:34	2/26/10	13:49:25	14:49:25	62.7	74.1	B&K 2236	GD
ST-180	3815 Edison	City of Bakersfield	35.36294444	-118.9343056			X							2/26/10	13:50:00	14:50:00	66.9	75.2	LDL 820	BV
ST-181	Virginia Avenue School (3301 Virginia Avenue, Bakersfield, CA 93307-2931)	City of Bakersfield	35.36122222	-118.9476944			X				X		Bell at school rang @ 11:28, 11:43, 11:48, 12:13; Air conditioning unit ran @ 11:40-11:45	3/1/10	11:19:24	12:19:24	59.3	71.3	B&K 2236	GD
ST-182	Unitarian Universalist Fellowship (Corner of Deacon Street and Sterling Road)	City of Bakersfield	35.36111111	-118.9404444			X					X		3/1/10	11:20:00	12:20:00	54.0	65.9	LDL 820	ML
ST-183	317 Sterling	City of Bakersfield	35.36533333	-118.9406389	X		X		X				Train 50 feet away	3/1/10	11:20:00	12:20:00	61.0	72.9	LDL 820	BV
ST-184	Foothill High School (501 Park Drive, Bakersfield, CA 93306-6099)	City of Bakersfield	35.36344444	-118.9180556	X		X			X		X		3/1/10	13:39:15	14:39:15	52.4	58.1	B&K 2236	GD
ST-185	The Church of Jesus Christ of Latter Day Saints (851 Monica Street)	City of Bakersfield	35.36261111	-118.9049167			X					X	Ambient	3/1/10	13:40:00	14:40:00	57.3	65.6	LDL 820	ML
ST-186	300 Royal	City of Bakersfield	35.36211111	-118.9099167	X		X						A lot of traffic at this location	3/1/10	13:40:00	14:40:00	61.1	65.8	LDL 820	BV
ST-187	Edison Middle School (721 Edison Road, Bakersfield, CA 93307)	City of Bakersfield	35.34927778	-118.8784444			X							3/2/10	13:39:23	14:39:23	67.1	76.3	B&K 2236	GD
ST-188	415 Monica Street	City of Bakersfield	35.35838889	-118.9047778						X		X		3/2/10	13:40:00	14:40:00	54.6	63.7	LDL 820	ML
ST-189	532 Pepper	City of Bakersfield	35.35066667	-118.8735556	X							X		3/2/10	13:40:00	14:40:00	60.9	70	LDL 820	BV
ST-190	Penn Elementary School (2201 San Emidio Street, Bakersfield, CA 93304-1125)	City of Bakersfield	35.36572222	-119.0286389	X		X			X		X		3/4/10	9:47:53	10:39:41	53.1	63	B&K 2236	GD
ST-191	3131 Truxton Avenue - Corner of Oak Street and Truxton Ave	City of Bakersfield	35.37327778	-119.0382778			X						Last ten minutes of readings weed-whacker was used on property	3/4/10	9:40:00	10:40:00	71.5	75.7	LDL 820	ML
ST-192	3114 Chester Lane	City of Bakersfield	35.36500000	-119.0382500			X		X					3/4/10	9:40:00	10:40:00	63.6	65.7	LDL 820	BV
ST-193	Beale Park (Corner of Dracena Street and Oleander Avenue)	City of Bakersfield	35.36305556	-119.0253611			X			X		X		3/4/10	11:19:20	12:19:20	57.2	66.8	B&K 2236	GD

Table D-3
Short-Term Noise Measurement Analysis Detail

Measurement Site Information					Measurement Source Information									Measurement Information							
			Coordinates		Noise Sources																
Site ID	Address	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Rail	Grade Crossing	Roadway	Aircraft	Industrial / Commercial	Community / Housing	Children Playing	Dogs / Birds	Comments	Date	Start Time	End Time	L_{eq} (dBA)	Estimated L_{dn} (dBA)	Instrumentation	Eng / Tech
ST-194	Church of the Brethren (2471 Palm Street @ A Street)	City of Bakersfield	35.36116667	-119.0295556			X				X		Ambient	3/4/10	11:20:00	12:20:00	66.1	67.5	LDL 820	ML
ST-195	1608 E Street	City of Bakersfield	35.37275000	-119.0245556	X		X	X		X		X		3/4/10	11:20:00	12:20:00	57.0	59.8	LDL 820	BV
ST-196	Lowell Park (Corner of 4th Street and P Street)	City of Bakersfield	35.36100000	-119.0111667			X					X		3/5/10	10:09:21	11:09:21	61.2	65.7	B&K 2236	GD
ST-197	Beale Park (1980 Palm Street)	City of Bakersfield	35.36155556	-119.0241667			X					X		3/5/10	10:10:00	11:10:00	54.2	56.5	LDL 820	ML
ST-198	10th Street	City of Bakersfield	35.36633333	-119.0203056			X						Construction occurring during measurement	3/5/10	10:10:00	11:10:00	61.8	73.4	LDL 820	BV
ST-199	Bakersfield Police Activity League (413 East 3rd Street (Corner or Marsh & 3rd)	City of Bakersfield	35.35933333	-118.9997778			X				X	X		3/5/10	13:40:00	14:40:00	57.8	60.5	LDL 820	ML
ST-200	John Fremont School	City of Bakersfield	35.35741667	-118.9985833			X				X	X		3/5/10	13:40:00	14:40:00	56.7	59.4	LDL 820	BV
ST-201	Trinity Methodist Church (Corner of Niles and King Street)	City of Bakersfield	35.38191667	-118.9896111			X	X				X	People talking to me @ 10:55; Plane overhead 11:03	3/8/10	10:40:00	11:40:00	61.0	62.7	B&K 2236	RM
ST-202	1070 Tulare	City of Bakersfield	35.38044444	-118.9951111	X		X	X				X	Small twin engine plane overhead	3/8/10	10:40:00	11:40:00	55.6	57.2	LDL 820	BV
ST-203	Bastro Park (Corner of Elm Street and 18th Street)	City of Bakersfield	35.37530556	-119.0361111			X				X	X	Ambient	3/8/10	13:50:00	14:50:00	61.0	69	B&K 2236	RM
ST-204	2330 Elm Street	City of Bakersfield	35.38083333	-119.0361944			X	X					A lot of traffic at this location	3/8/10	13:50:00	14:50:00	69.7	69.9	LDL 820	BV

Appendix E
Field Vibration Measurement Documentation and Detail

This appendix contains various exhibits and examples of how field ground-vibration measurements were documented and analyzed. These include:

- A sample field measurement data sheet for a ground vibration measurement (Figure E-1).
- Sample field photograph sets for a ground vibration measurement site (Figure E-2).
- Data analysis table for ground vibration measurements (Table E-1).

A complete set of ground vibration measurement data sheets and measurement site locations photographs are maintained as part of the project file. The field vibration measurement sheets are included in Appendix E-1, which is a separate document.

FIELD MEASUREMENT DATA SHEET

URS **Project Name:** Fresno to Bakersfield Labor **Job #** 27560811.53030100

ID

SITE IDENTIFICATION: V-05 **OBSERVER(s):** TED LINDBERG
START DATE & TIME: 11-30-09 14:00 **END DATE & TIME:** 12-1-09
ADDRESS: 12013 COMPASS AVENUE

GPS coordinates: 35° 23.427′ N 119° 08.160′ W

Weather

TEMP:______° F HUMIDITY:______% R.H. WIND: **CALM LIGHT MODERATE VARIABLE**
WINDSPEED:__________MPH DIR: **N NE E SE S SW W NW** **STEADY GUSTY**____MPH
SKY: **CLEAR SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN** Other: ________

Acoustic Measurements

INSTRUMENT: 2250 **TYPE:** 1 2 **SERIAL #:**
CALIBRATOR: **SERIAL #:**

ACCELEROMETER MOUNTING: **MASS** X **STAKE**______ **WEDGE**______ **OTHER**______

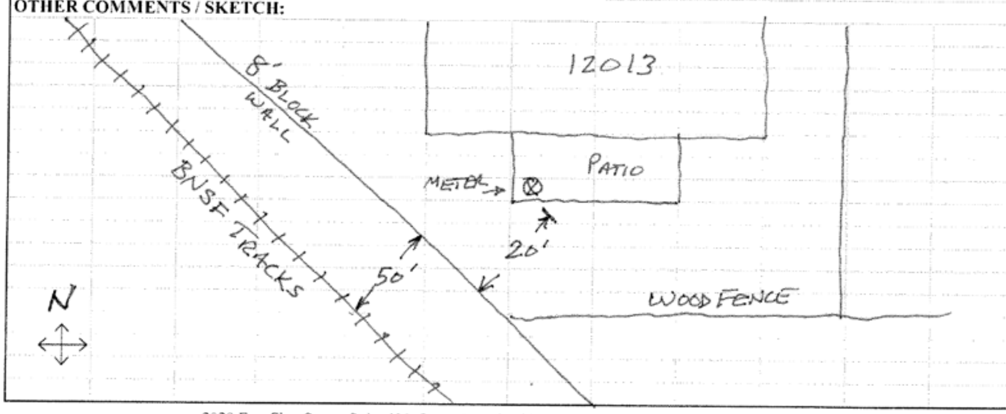
SETTINGS: **Octave** **1/3-Octave** **Narrow Band** **ACC** **VELOCITY** **DISP** **X-Axis** **Y-Axis** **Z-Axis**

	Rec #	Start Time	Event Time	End Time	Source	
11/30	25	15:47	15:48	15:49	AMTRAK - EB	
12/01	26	10:00	10:18	10:19	AMTRAK - WB	
	27	10:20	10:36	10:38	BNSF - EB	10:31 C-130 OH
	28	10:39	10:43	10:46	BNSF - EB	PRECEEDED BY DOG BARKS
	29	10:48	10:59	11:01	BNSF - WB	
	30	11:03	11:37	11:38	AMTRAK - EB	

COMMENTS:

Description / Sketch

TERRAIN: **HARD SOFT MIXED FLAT OTHER:**
PHOTOS: ✓
OTHER COMMENTS / SKETCH:



measform3.xls

2020 East First Street, Suite 400, Santa Ana, CA 92705, 714-835-6886 fax 714-433-7701

Figure E-1
Sample ground vibration field measurement data sheet

	**Photograph 1** **Date:** 12/16/09 **Comments:** Vib-06. Address: 8611 Avenue 32. Earlimart, CA.
	**Photograph 2** **Date:** 03/08/10 **Comments:** Vib-07. Address: 417 Dolores Street. Bakersfield, CA.

Figure E-2
Sample ground vibration measurement site photos

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Table E-1
Ground Vibration Measurement Analysis and Detail

ID	Location	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Date	Start time	Event Description	Distance to Tracks (feet)	Measured Maximum VdB	Base RMS VdB from FTA Fig. 10-1	Train Speed	Speed Adjustment	Measured VdB - FTA Model
V-01	11901 Snowberry Lane, Bakersfield, CA, 93312	City of Bakersfield	35.3889667	-119.1349667	11/18/09	15:19	BNSF Freight Eastbound	65 ft	83.6	84	45	-1	-6.4
						15:46	Amtrak Eastbound		67.8	84	45	-1	-22.2
						15:57	Amtrak Westbound		67.9	84	45	-1	-22.1
						15:58	BNSF GT Eastbound		75.6	84	45	-1	-14.4
						16:18	BNSF GT Westbound		82.2	84	45	-1	-7.8
						16:46	BNSF DS Eastbound		78.1	84	45	-1	-11.9
V-02	10429 Glenn Street, Green Acres, CA, 93312	City of Bakersfield	35.3772333	-119.1189167	11/19/09	10:17	Amtrak Westbound	92 ft	91.7	84	40	-2	7.7
						10:28	BNSF Westbound		77.3	84	40	-2	-6.7
						11:37	BNSF Eastbound		76.5	84	40	-2	-7.5
						11:40	Amtrak Eastbound		70.8	84	40	-2	-13.2
						11:58	BNSF Westbound		79.1	84	40	-2	-4.9
						12:06	AMBIENT		60.4	84	- -	- -	-23.6
V-03	2500 Jewetta Ave #27, Bakersfield, CA 93312	City of Bakersfield	35.38105	-119.1252167	11/20/09	10:42	AMBIENT	60 ft	56.8	84	- -	- -	-34.2
						11:09	BNSF Westbound		81.8	84	45	-1	-9.2
						12:31	Amtrak and BNSF		80.5	84	45	-1	-10.5
						13:06	BNSF		81.2	84	45	-1	-9.8
						13:29	Amtrak (2) w/ MC		74.6	84	45	-1	-16.4
						14:28	BNSF Eastbound		78.4	84	45	-1	-12.6
						15:16	Amtrak		74.7	84	45	-1	-16.3
						15:55	Amtrak		71.2	84	45	-1	-19.8
V-04	11501 Mockingbird Court, Bakersfield, CA, 93312	City of Bakersfield	35.3845	-119.12955	11/30/09	11:43	Amtrak EB 1/6	105–110 ft	64.5	84	45	-1	-18.5
						12:24	BNSF Engines 2/0		66.2	84	45	-1	-16.8
						12:45	BNSF Freight Eastbound 3/28/2		67.3	84	45	-1	-15.7
						12:52	BNSF DS Westbound 4/98/0		76	84	45	-1	-7
V-05	12013 Compass Avenue, Bakersfield, CA, 93312	City of Bakersfield	35.39045	-119.136	11/30/09	15:47	Amtrak Eastbound	70 ft	64.6	84	45	-1	-24.4
						10:00	Amtrak Westbound		75.6	84	45	-1	-13.4
						10:20	BNSF Eastbound		69.7	84	45	-1	-19.3
						10:39	BNSF Westbound		74.9	84	45	-1	-14.1
						10:48	BNSF Westbound		75.2	84	45	-1	-13.8
						11:03	Amtrak Eastbound		77.2	84	45	-1	-11.8

Table E-1
Ground Vibration Measurement Analysis and Detail

ID	Location	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Date	Start time	Event Description	Distance to Tracks (feet)	Measured Maximum VdB	Base RMS VdB from FTA Fig. 10-1	Train Speed	Speed Adjustment	Measured VdB - FTA Model
V-06	8611 Ave. 32, Earlimart, CA 93219	County of Kern	35.8464667	-119.3751333	12/16/09	11:08	Amtrak EB 1/4	75 ft	68.6	84	45	-1	-19.4
						12:07	BNSF EB 4/ / 2		81.9	84	45	-1	-6.1
						12:42	Amtrak EB 1/4		65.1	84	45	-1	-22.9
						14:23	Amtrak WB 1/4		61.4	84	45	-1	-26.6
						15:19	Amtrak EB 1/4		65.7	84	45	-1	-22.3
						16:28	Amtrak WB 1/4		66	84	45	-1	-22
						16:31	BNSF EB 4/		71.2	84	45	-1	-16.8
V-07	417 Dolores Street, Bakersfield, CA 93305	City of Bakersfield	35.3724167	-118.9985	3/8/10	8:47	BNSF - WB 2/117 TOFC Empty @ 25 mph	165 ft	78	84	25	-6	6
						10:26	BNSF - EB 75/2 Tank Cars @ 25 mph		69.6	84	25	-6	-2.4
						12:05	AMBIENT		60.8	84	- -	- -	-11.2
V-08	721 Oswell Street, Bakersfield, CA 93306	City of Bakersfield	35.3671667	-118.94885	3/8/10	13:15	BNSF - EB Mixed 4/88/2 @ 45mph	93 ft	74.3	84	45	-1	-10.7
						13:43	SJVR - EB Mixed 2/23 @ 25 mph		62.5	84	25	-6	-22.5
						15:31	AMBIENT		69.1	84	- -	- -	-15.9
V-09	250 Fairfax Road Site 320, Bakersfield Palms RV Park, Bakersfield, CA 9330	City of Bakersfield	35.3617667	-118.9294833	3/9/10	8:16	BNSF - WB - Center flows - 4/58/2/42/2 @35-45 mph	163 ft	53.7	84	40	-2	-23.3
						9:14	UP - EB 20 Engines @ 40 mph		55.7	84	40	-2	-21.3
						9:51	UP - WB DS /92/1 @ 35-45 mph		59.1	84	40	-2	-17.9
						11:05	AMBIENT		55.8	84	- -	- -	-21.2
V-10	2264 N. Heron Place, Hanford, CA 93230	City of Hanford	36.353	-119.6636	6/30/10	14:40	Amtrak - EB - 4/1 @ 45 mph	108 ft	82.8	84	45	-1	-0.2
						14:47	Amtrak - WB - 1/4 @ 45 mph		85.6	84	45	-1	2.6
						15:15	BNSF - EB - Mixed - 3/55/2 @ 45 mph		94.9	84	45	-1	11.9
						15:26	BNSF - EB - Grain - 3/108 @ 45 mph		87.6	84	45	-1	4.6
						15:48	BNSF - EB - Mixed - 4/95/2 @ 45 mph		96	84	45	-1	13
						17:11	Amtrak - WB - 1/4 @ 45 mph		78.5	84	45	-1	-4.5
						17:15	BNSF - EB - Mixed - 3/88/2 @ 45 mph		82.7	84	45	-1	-0.3
						17:45	BNSF - EB - Mixed - 4/103/2 @ 30 mph		80.3	84	30	-4	0.3
						17:52	Amtrak - EB - 4/1 @ 50 mph		81.4	84	50	-2	-2.6
						18:05	BNSF - EB - Mixed - 2/3 @ 45 mph		85.3	84	45	-1	2.3

Table E-1
Ground Vibration Measurement Analysis and Detail

ID	Location	Jurisdiction	Latitude (degrees)	Longitude (degrees)	Date	Start time	Event Description	Distance to Tracks (feet)	Measured Maximum VdB	Base RMS VdB from FTA Fig. 10-1	Train Speed	Speed Adjustment	Measured VdB - FTA Model
V-11	1158 W. Northstar Dr., Hanford, CA 93230	City of Hanford	36.3602	-119.6634	7/1/10	11:30	BNSF - EB - UPS TOFC - 4/75 @ 45 mph	166 ft	79.8	84	45	-1	2.8
						11:32	Amtrak - WB - 1/4 @ 45 mph		78.1	84	45	-1	1.1
						12:05	Amtrak - EB - 4/1 @ 45 mph		84.9	84	45	-1	7.9
						12:18	BNSF - WB - Mixed - 3/90/2 @ 45 mph		79.4	84	45	-1	2.4
						13:06	BNSF - EB - Mixed - 3/76/2 @ 45 mph		78.4	84	45	-1	1.4
						13:24	BNSF - EB - DS-TOFC - 4/90 @ 30-35 mph		77.7	84	30	-4	3.7
						13:45	BNSF - WB - DS-TOFC - 4/109 @ 45 mph		80.7	84	45	-1	3.7
						13:58	BNSF - WB - Coil Cars - 3/53/1 @ 45 mph		83.4	84	45	-1	6.4
						14:39	Amtrak - EB - 4/1 @ 50 mph		73.1	84	50	0	-4.9
						14:45	Amtrak - WB - 1/4 @ 45 mph		77.5	84	45	-1	0.5
						15:48	BNSF - WB - 6 @ 45 mph		77.9	84	45	-1	0.9
V-12	2098 N. Heron Place, Hanford, CA 93230	City of Hanford	36.34939	-119.663346	7/2/10	10:13	BNSF - WB - DS-TOFC - 4/105 @ 45 mph	183 ft	74	84	45	-1	-2
						10:54	BNSF - EB - 3 @ 45 mph		69	84	45	-1	-7
						10:57	BNSF - WB - Mixed - 5/86 @ 45 mph		79.5	84	45	-1	3.5
						11:28	BNSF - WB - Auto Racks - 3/71 @ 40 mph		73	84	40	-2	-2
						11:44	Amtrak - WB - 1/4 @ 45 mph		65.9	84	45	-1	-10.1

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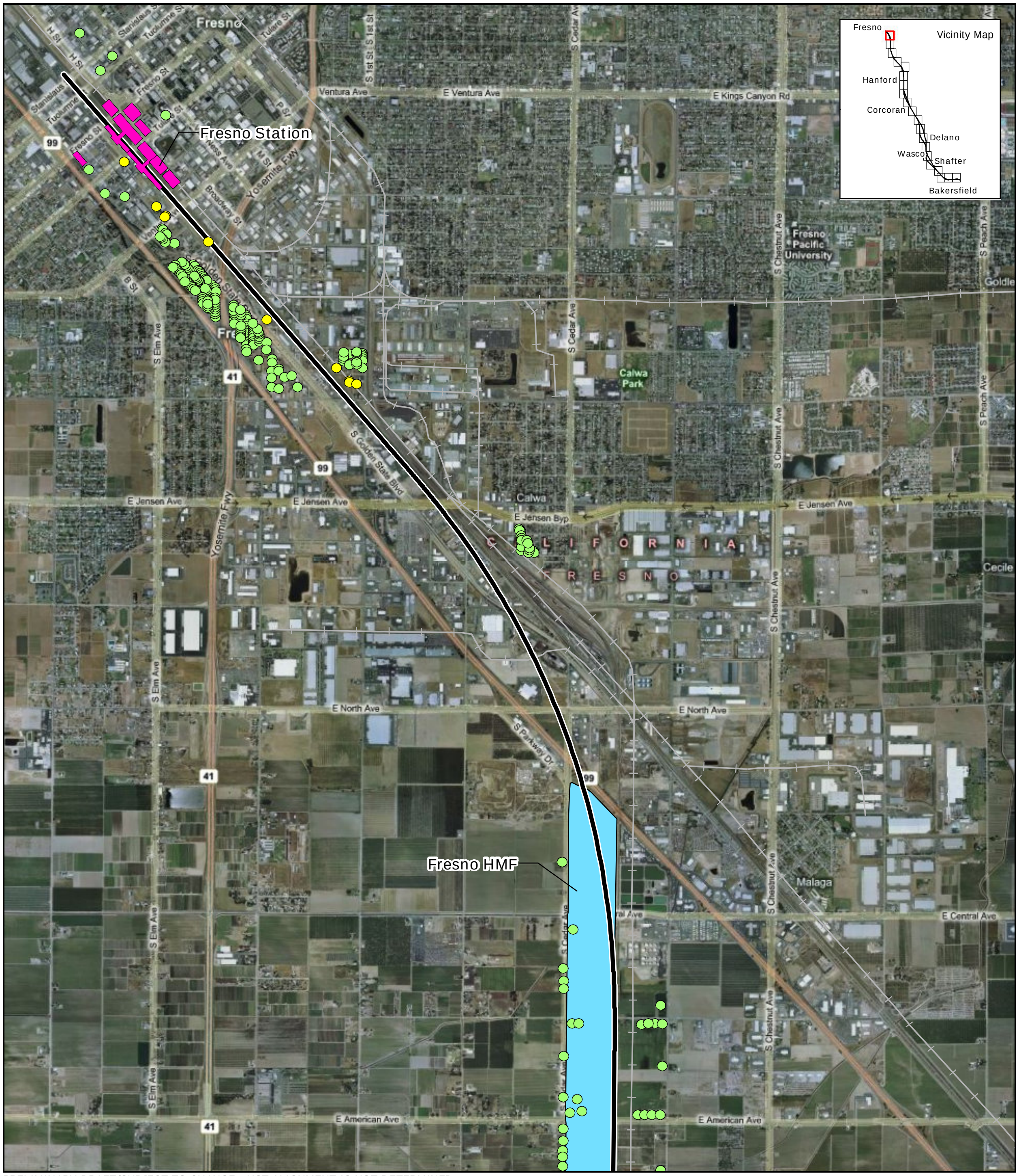
Appendix F
Noise Impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

Data source: URS, 2011

June 2, 2011

N

0 1,000 2,000

Feet

0 500 1,000

Meters

BNSF Alternative (Bypasses labeled)

Existing rail line

Steam/River

Highway

County boundary

Potential heavy maintenance facility

Proposed station

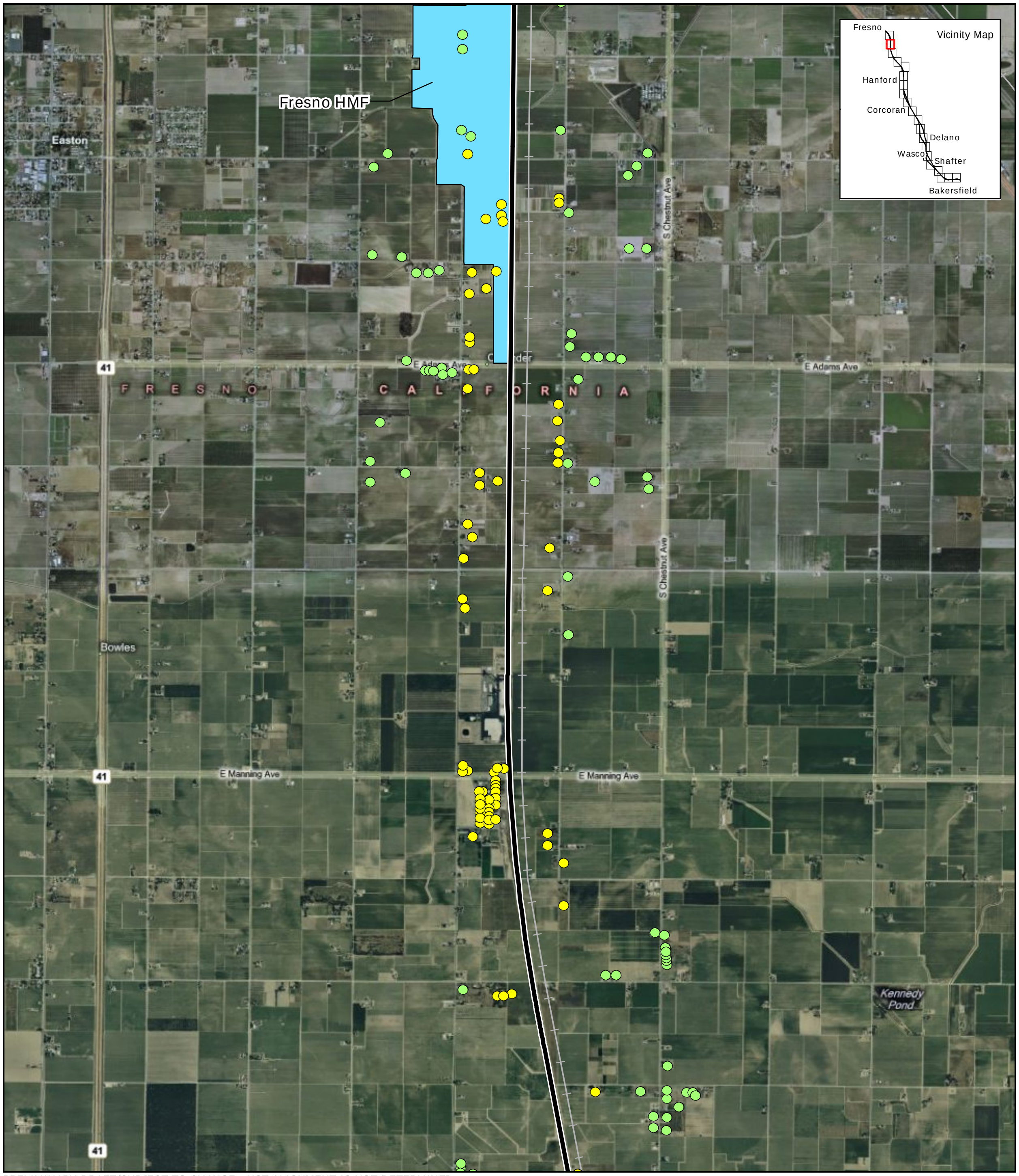
Potential Kings/Tulare Regional Station

Moderate noise impact location

Severe noise impact location

Figure **F**-1

Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

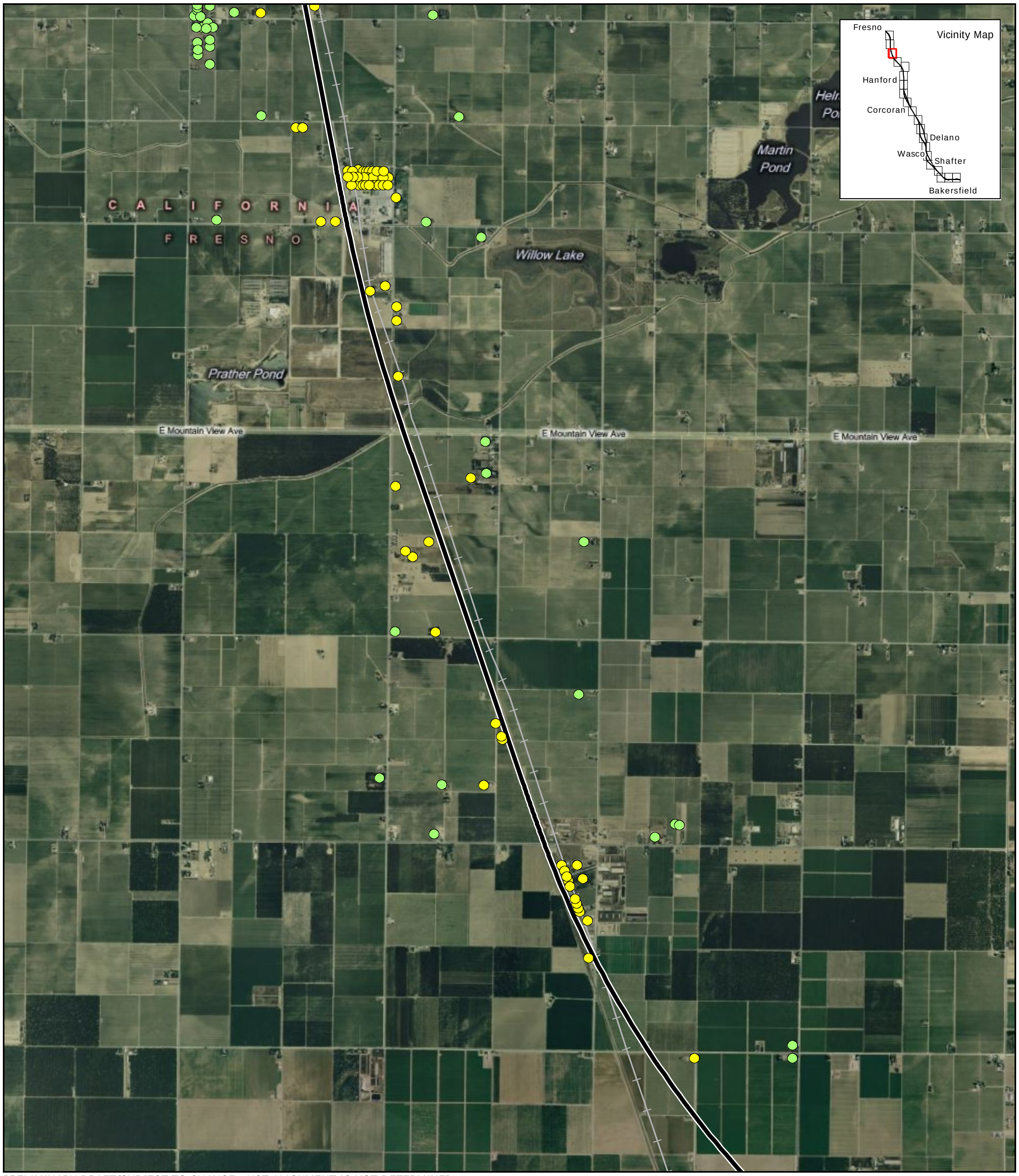
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

N

0 1,000 2,000
Feet

0 500 1,00
Meters

Figure F-2
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

Figure **F**-3
Noise impacts

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011

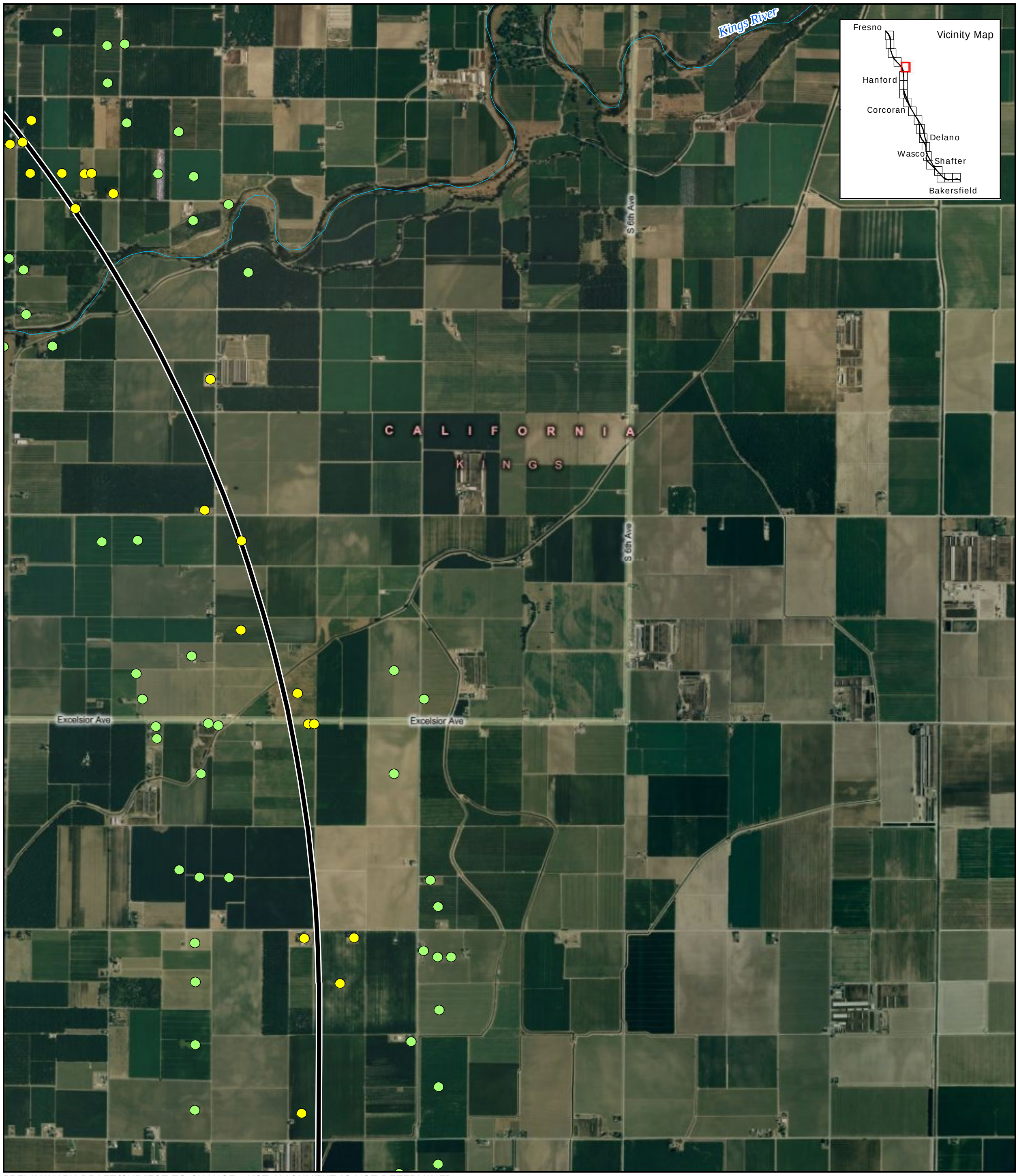
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **F**-4
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

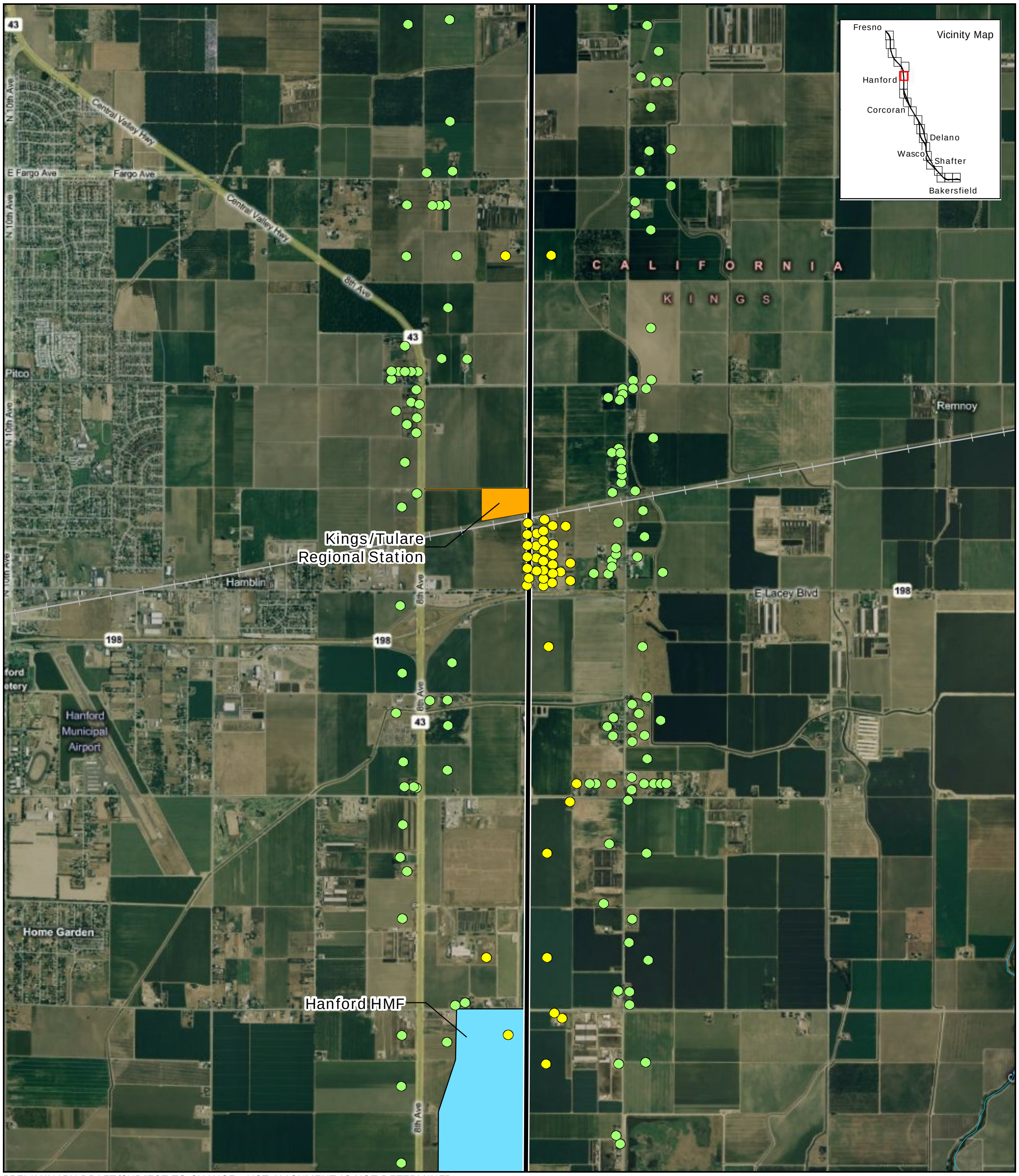
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

Figure **F**-5
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

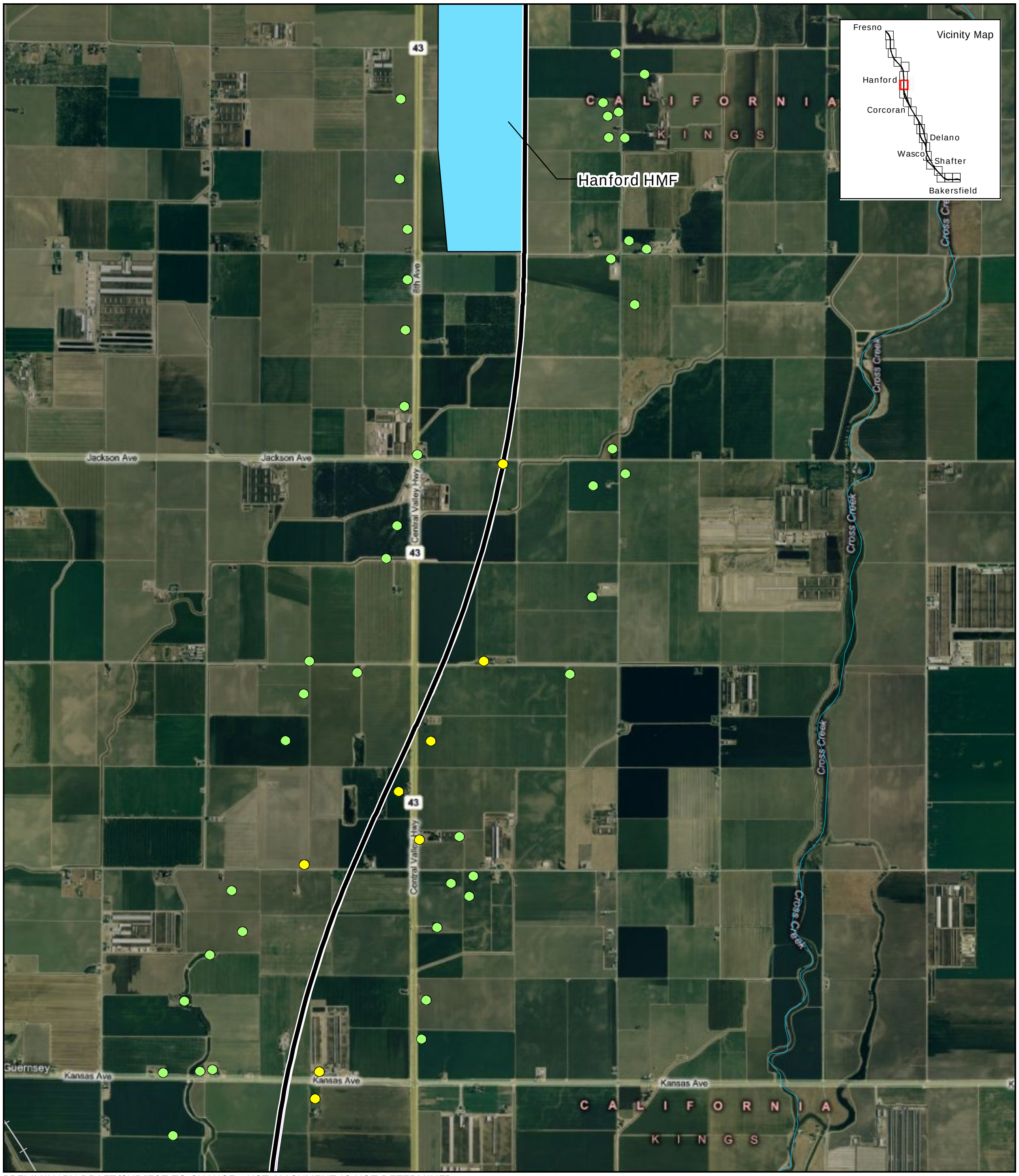
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

Figure **F**-6
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

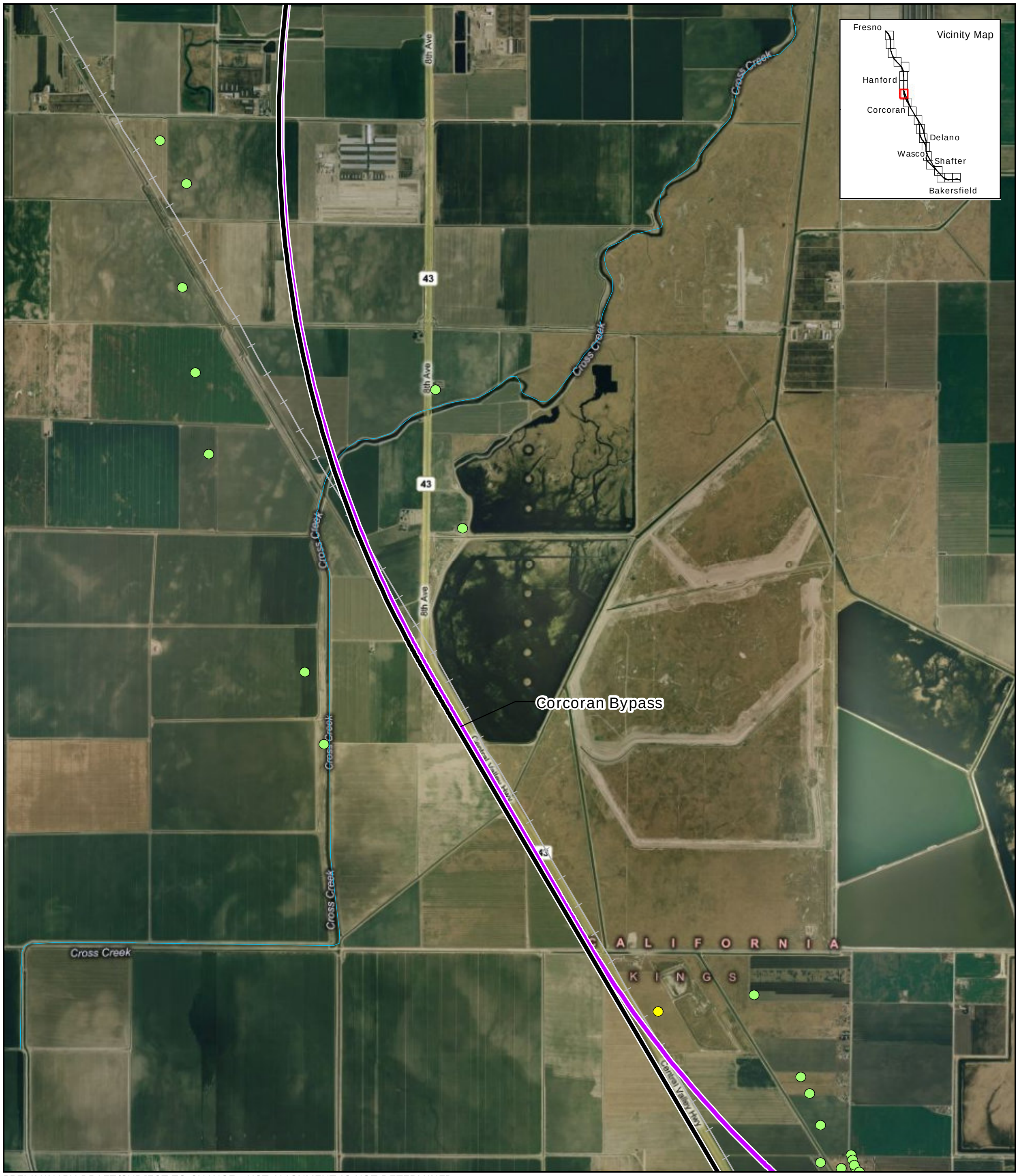
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

Figure **F**-7
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

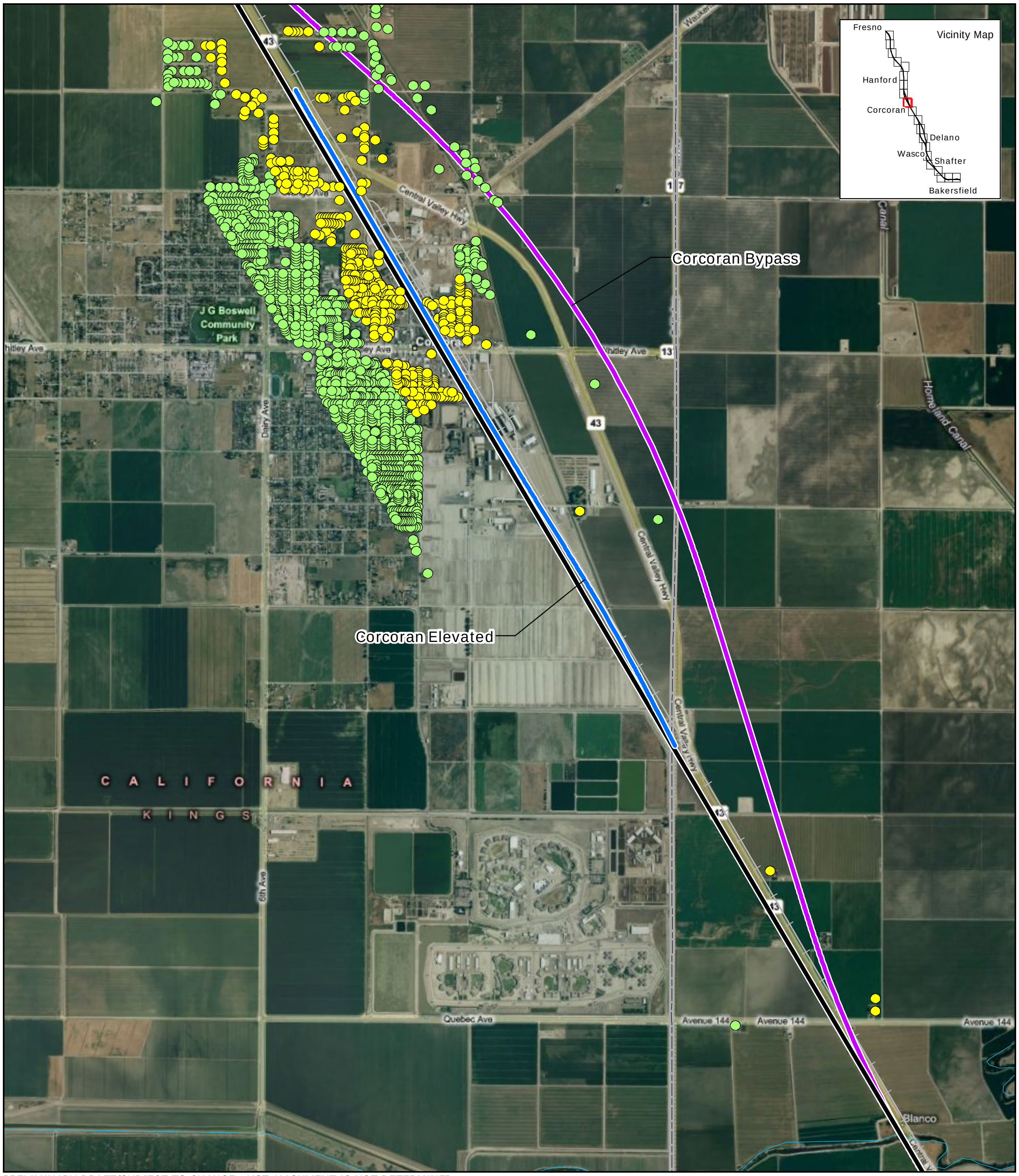
N

0 1,000 2,000
Feet

0 500 1,000
Meters

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

Figure **F**-8
Noise impacts



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June 2, 2011

Data source: URS, 2011

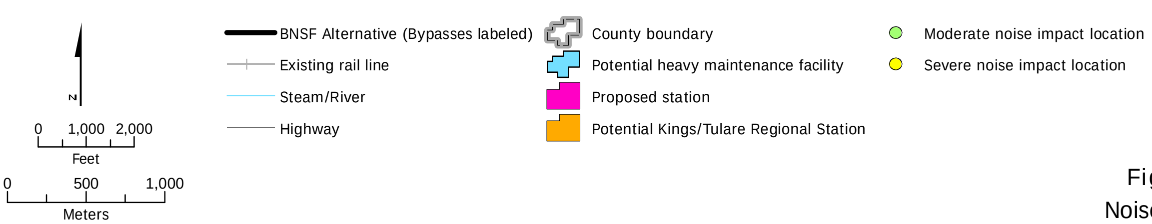


Figure **F**-9
Noise impacts

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

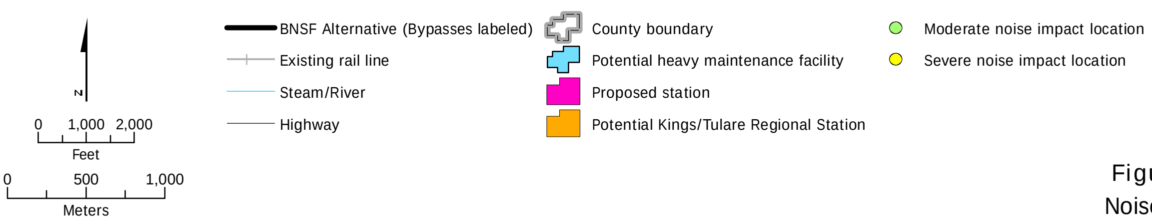


Figure **F**-10
Noise impacts

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

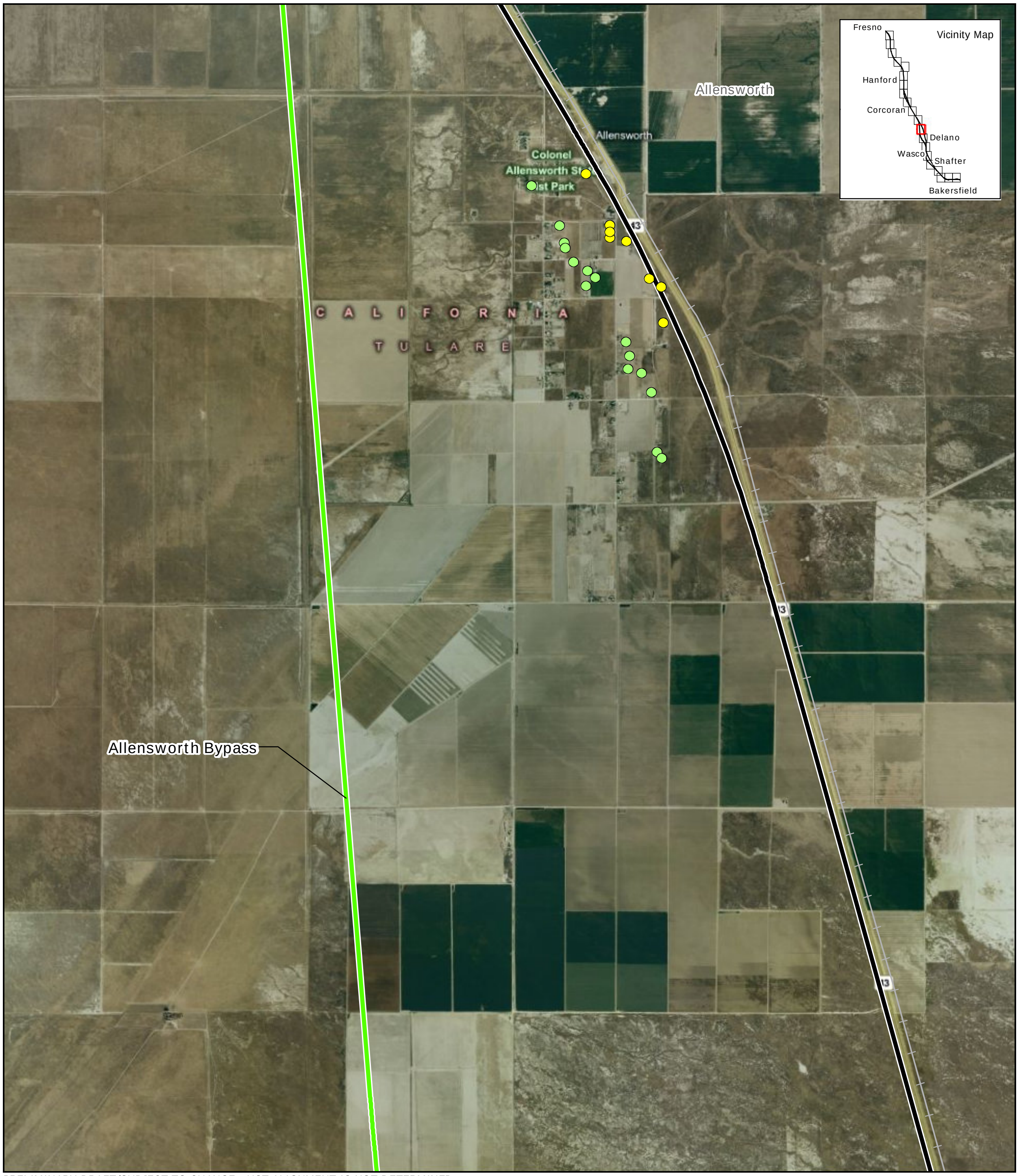
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

Figure **F**-11
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

Data source: URS, 2011

June 2, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
Highway
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Moderate noise impact location
Severe noise impact location

Figure **F**-12
Noise impacts

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **F**-13
Noise impacts

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

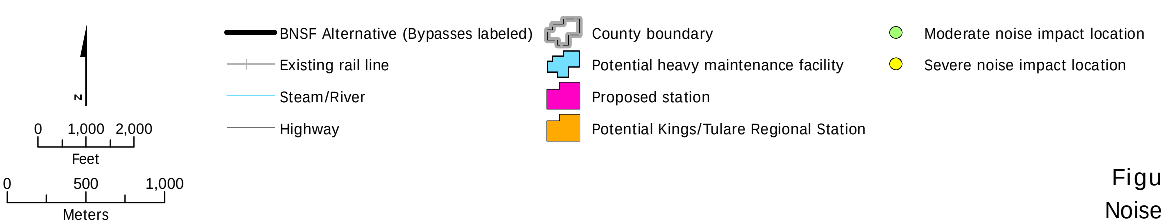
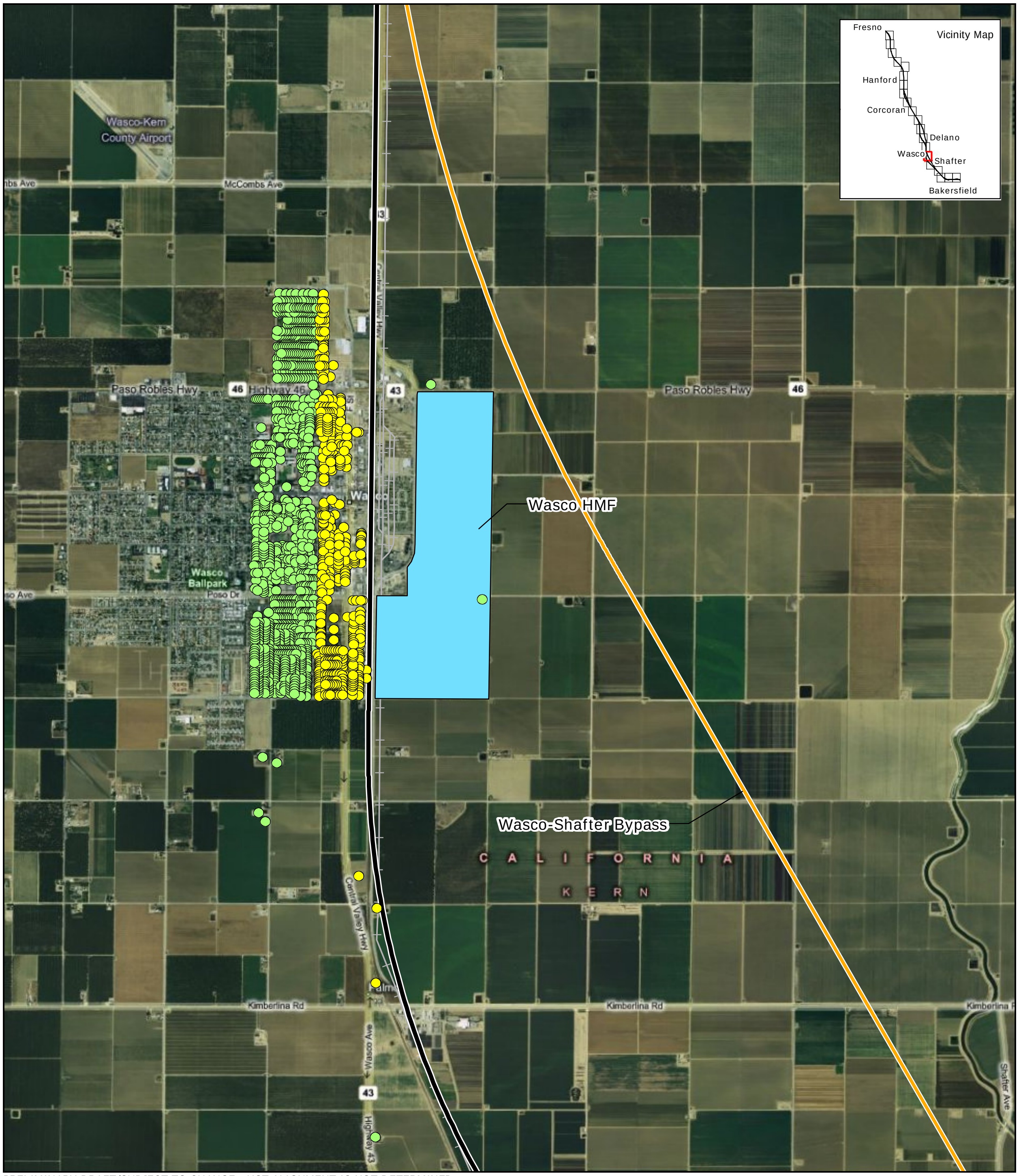


Figure **F**-14
Noise impacts



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June 2, 2011

Data source: URS, 2011

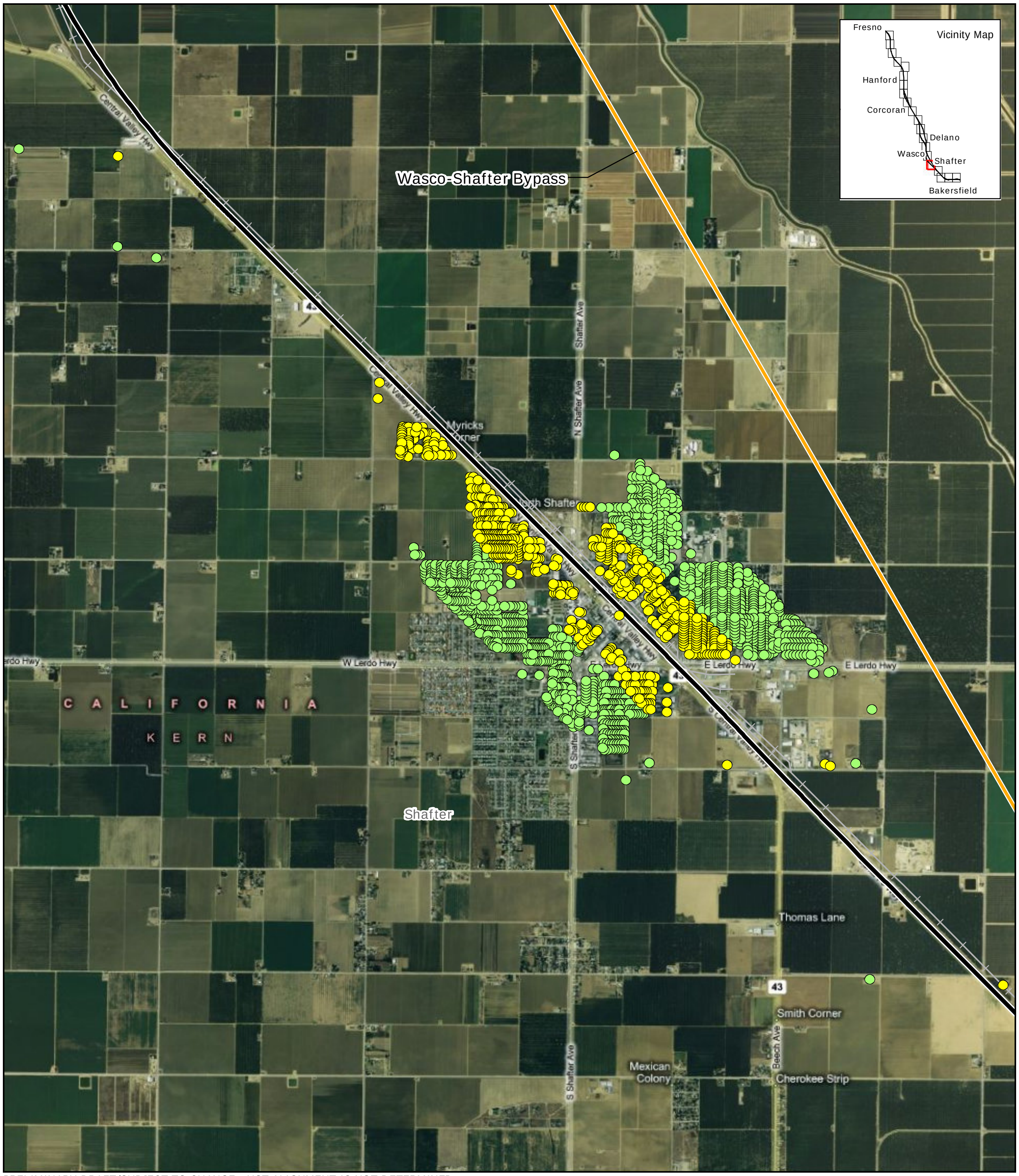
N

0 1,000 2,000 Feet

0 500 1,000 Meters

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

Figure **F**-15
Noise impacts



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June 2, 2011
Data source: URS, 2011

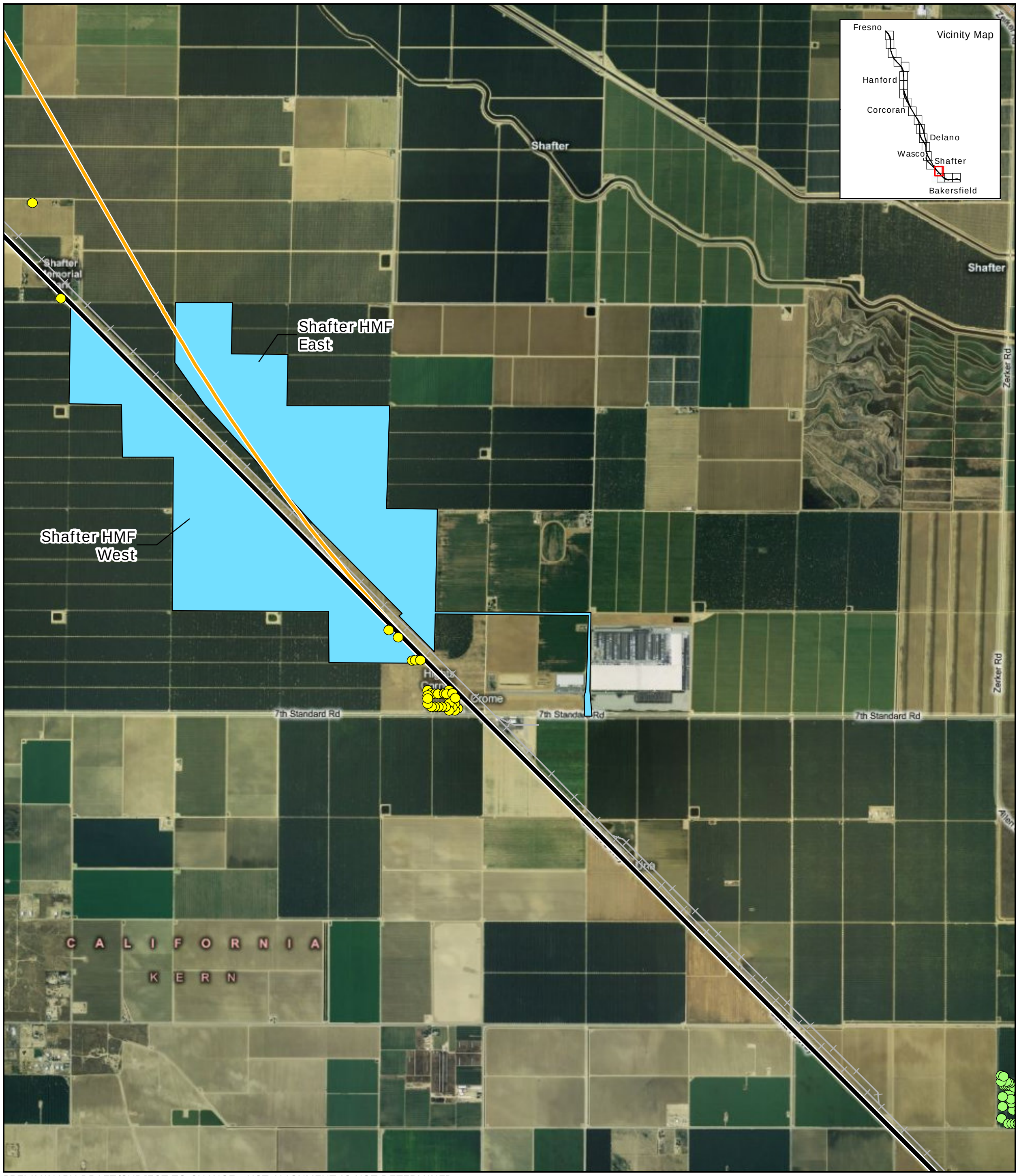
N

0 1,000 2,000
Feet

0 500 1,000
Meters

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

Figure **F**-16
Noise impacts



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June 2, 2011

Data source: URS, 2011

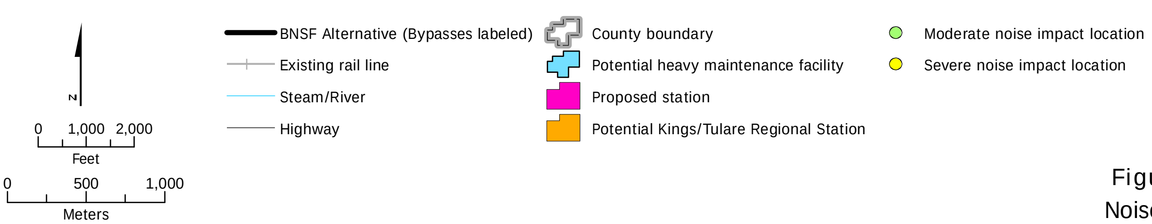
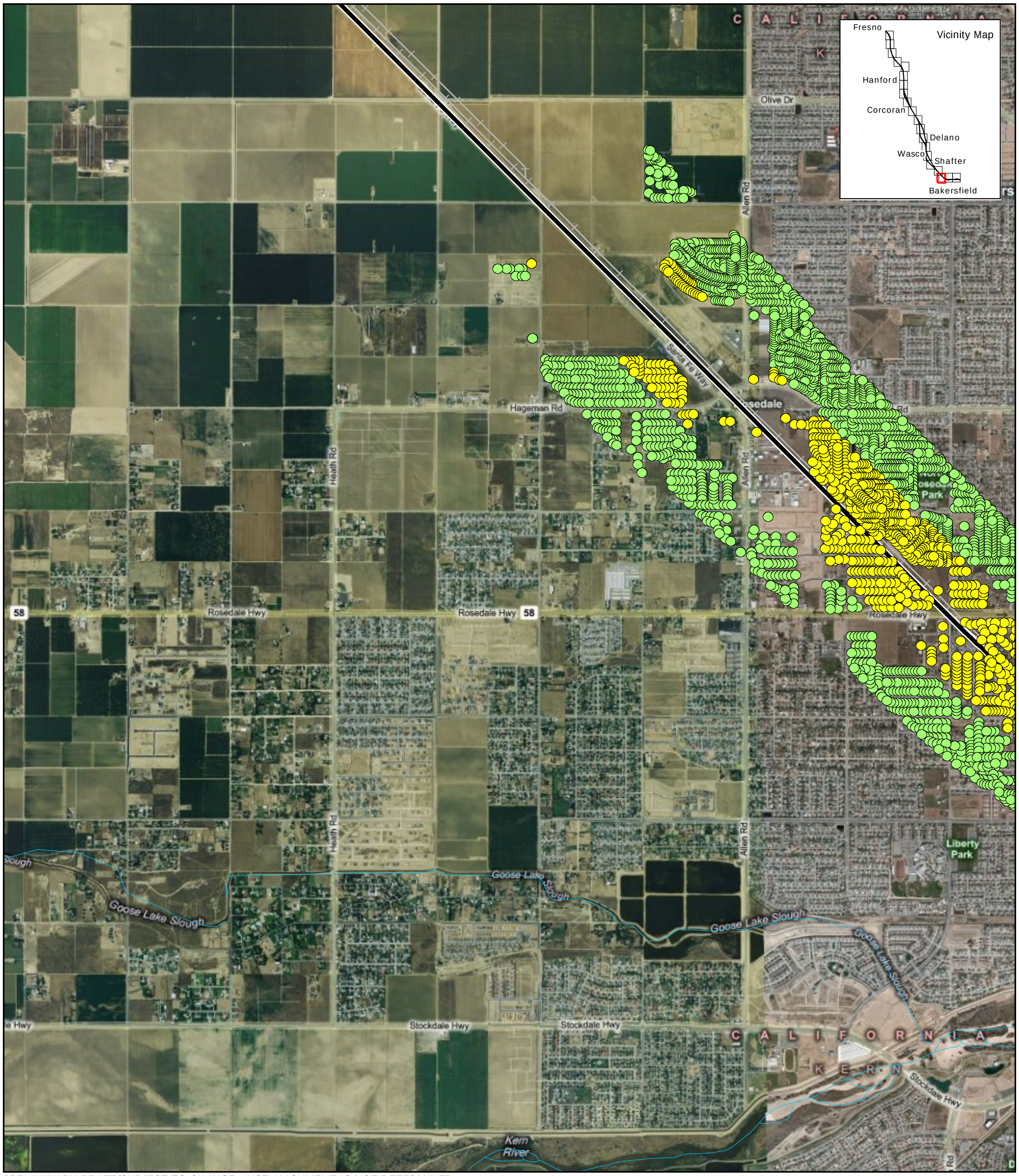


Figure **F**-17
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

BNSF Alternative (Bypasses labeled)

Existing rail line

Steam/River

Highway

County boundary

Potential heavy maintenance facility

Proposed station

Potential Kings/Tulare Regional Station

Moderate noise impact location

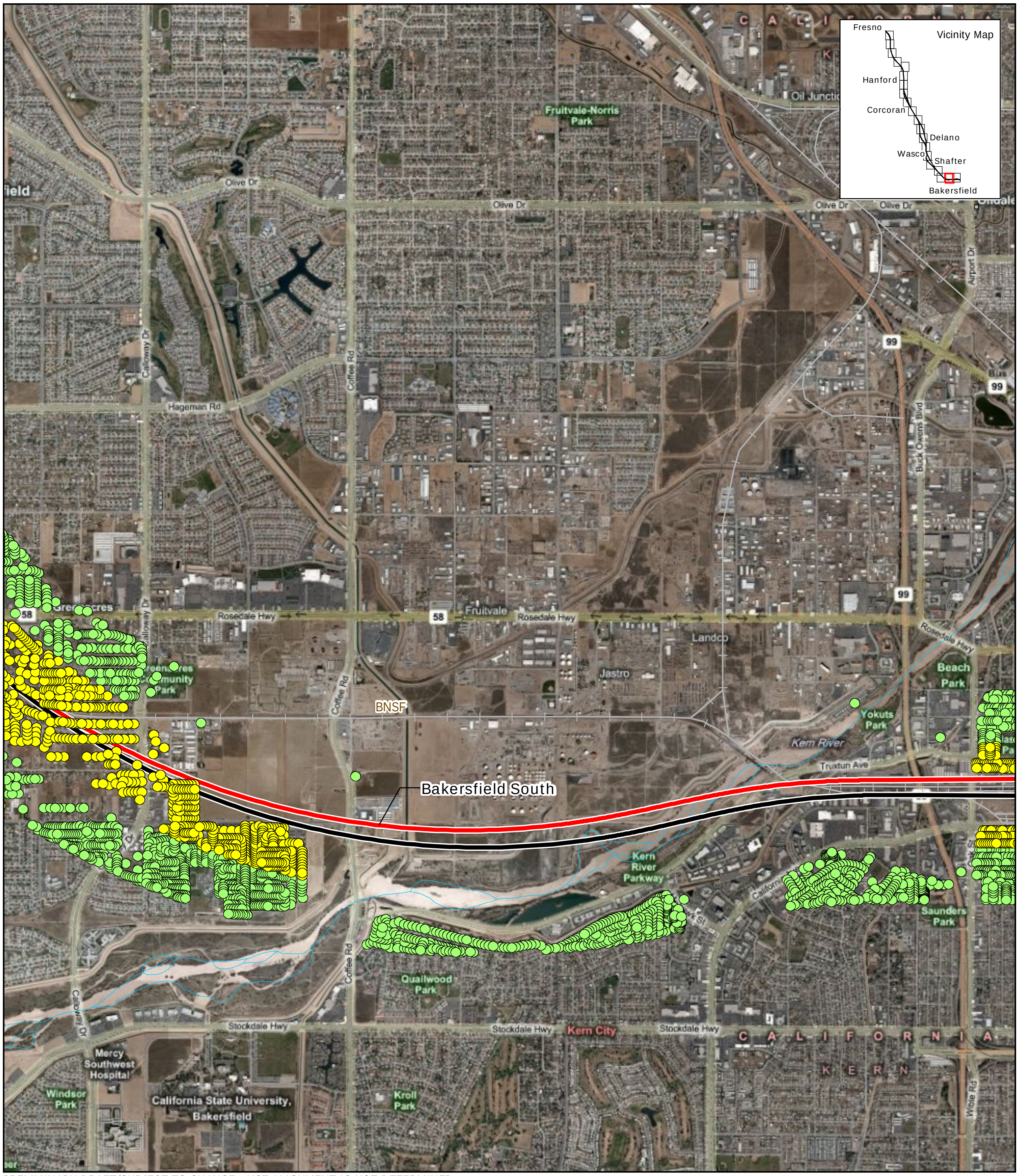
Severe noise impact location

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **F**-18
Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

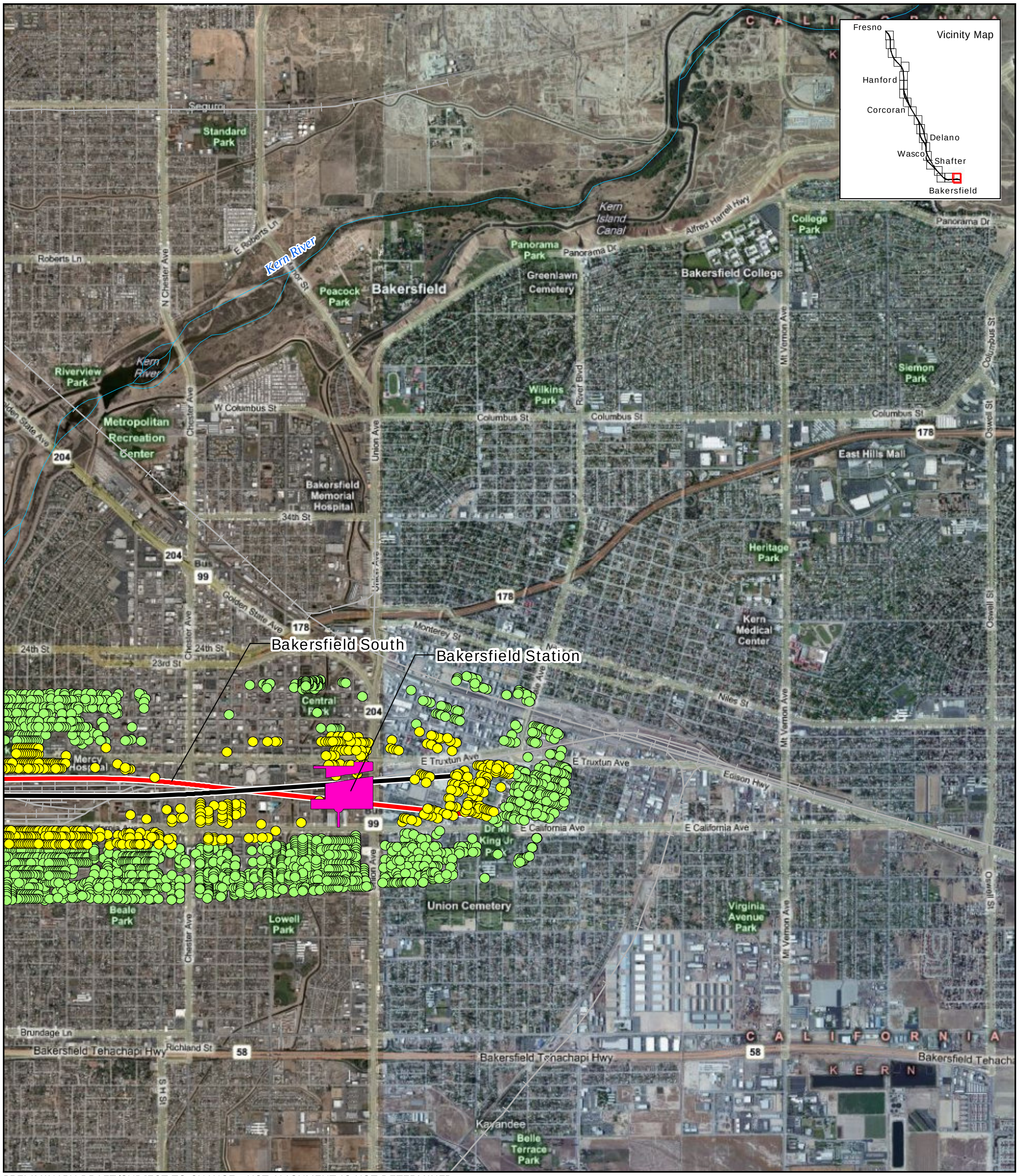
N

0 1,000 2,000 Feet

0 500 1,000 Meters

Figure **F**-19

Noise impacts



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- Highway
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Moderate noise impact location
- Severe noise impact location

Figure **F**-20
Noise impacts

Appendix G

Field Transfer Mobility Measurement and Documentation Detail

ATSConsulting
acoustics, transportation + strategy

MEMORANDUM

To: Ted Lindberg
URS

From: Andrew Somerville
ATS Consulting

Date: January 17, 2011

Subject: CAHSR Fresno to Bakersfield Segment Vibration Propagation Test Locations

This memorandum and accompanying spreadsheets present the protocol and results of 18 vibration propagation measurements taken to estimate the vibration transfer mobility along the proposed California High Speed Rail Alignment between Fresno and Bakersfield. The measurements were taken between December 14, 2010 and January 7, 2011. A description of the propagation test equipment and protocol is given below followed by descriptions of each test site.

Vibration testing was performed at 18 sites along the Fresno to Bakersfield CAHSR corridor. The measurement equipment consisted of:

- Transducers: PCB Model 393A03 Seismic Accelerometers (6)
- Data Recorders: Rion DA-20 4-channel digital data recorder (2)
- Accelerometer Calibrator: PCB Model 394C06 (1)
- Drop Hammer for transfer mobility tests (45 lb weight dropped 4 ft)
- Associated cables and field equipment

The accelerometers were mounted in the vertical direction. For paved surfaces, the accelerometers were attached to 4 inch square aluminum plates that were attached to the paved surface with a gel material (earthquake gel). Six inch steel stakes were used to attach the accelerometers to bare ground. The impact tests at each site were performed at 15 foot intervals along a 150 ft line. The transfer mobility and coherence results from the tests have been transmitted to URS in Excel spreadsheets. Transfer mobility is a measure of the relationship between the exciting force and the response at each accelerometer position. Coherence provides an indication of the data quality. Coherence close to 1 indicates a strong relationship between the impulse generated by the drop hammer and the response; coherence close to zero indicates a weak relationship. A general guideline is that the LSTM results should be used with caution when the coherence is less than 0.2. A coherence less than 0.2 usually indicates that the measured LSTM at that frequency is greater, sometimes substantially greater, than the true LSTM.

List of Test Sites

CAHSR FRESNO TO BAKERSFIELD SEGMENT VIBRATION PROPAGATION TEST LOCATIONS
JANUARY 17, 2011
PAGE 3

Site 1: East American Avenue and South Cedar Avenue

Test Date: 14 December 2010.

Impact line: Northern edge of East American Avenue, east of South Cedar Avenue.

Accelerometer Line: In the northeast quadrant of the intersection running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, 125, and 150 feet.

Site 1: Vibration Test Location

Site 1: East American Avenue and South Cedar Avenue

Site 2: East Manning Avenue and South Chestnut Avenue

Test Date: 14 December 2010.

Impact line: Western edge of South Chestnut Avenue, south of East Manning Avenue.

Accelerometer Line: In the southwest quadrant of the intersection running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.

Site 2: Vibration Test Location

Site 2: East Manning Avenue and South Chestnut Avenue

Site 3: East Nebraska Avenue and South Chestnut Avenue

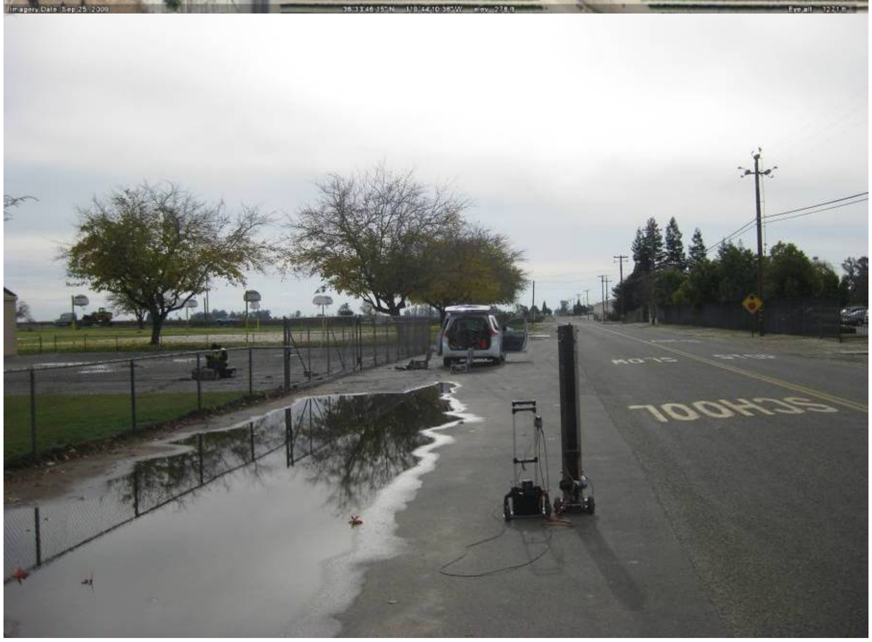
Test Date: 15 December 2010.

Impact line: Eastern edge of South Chestnut Avenue, north of East Nebraska Avenue.

Accelerometer Line: In the northeast quadrant of the intersection running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, 125, and 150 feet.

Site 3: Vibration Test Location



Site 3: East Nebraska Avenue and South Chestnut Avenue

Site 4: Elder Avenue and 9th Avenue

Test Date: 14 December 2010.

Impact line: Northern edge of Elder Avenue, perpendicular to 9th Avenue.

Accelerometer Line: Along the western edge of 9th Avenue perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, 125, and 150 feet.

Site 4: Vibration Test Location

Site 4: Elder Avenue and 9th Avenue

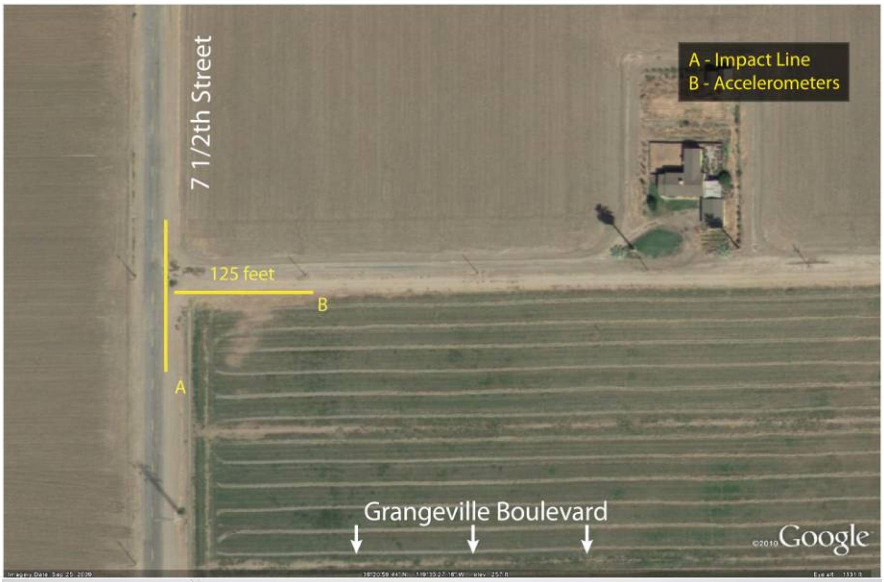
Site 5: Grangeville Boulevard and 7 1/2th Street

Test Date: 15 December 2010.

Impact line: Eastern Edge of 7 1/2th Street, north of Grangeville Boulevard.

Accelerometer Line: Perpendicular to the impact line along a small road just north of Grangeville Boulevard.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 150 feet.



Site 5: Vibration Test Location

Site 5: Grangeville Boulevard and 7 1/2th Street

Site 6: Kansas Avenue and 7th Avenue

Test Date: 15 December 2010.

Impact line: Northern edge of Kansas Avenue, perpendicular to 7th Avenue.

Accelerometer Line: Along the western edge of 7th Avenue perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, 125, and 150 feet.

Site 6: Vibration Test Location

Site 6: Kansas Avenue and 7th Avenue

Site 7: Nevada Avenue and 6th Avenue

Test Date: 5 January 2011.

Impact line: Northern edge of Nevada Avenue, perpendicular to 6th Avenue.

Accelerometer Line: Along the western edge of 6th Avenue perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 37.5, 50, 75, 100, and 125 feet.

Site 7: Vibration Test Location

Site 7: Nevada Avenue and 6th Avenue

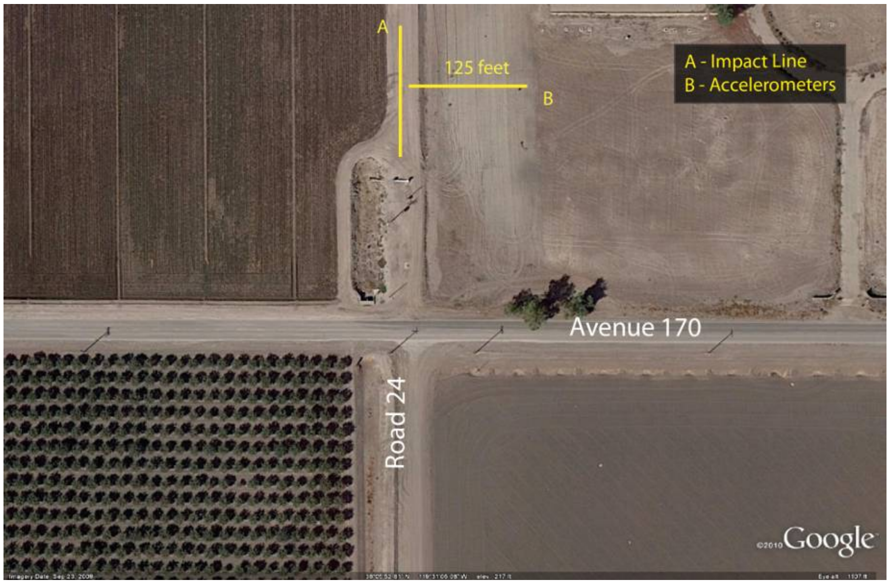
Site 8: Avenue 170 and Road 24

Test Date: 17 December 2010.

Impact line: Along Road 24 north of Avenue 170.

Accelerometer Line: In the northeast quadrant of the intersection running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.



Site 8: Vibration Test Location

Site 8: Avenue 170 and Road 24

Site 9: Avenue 112 and Highway 43 (Northeast of canal)

Test Date: 5 January 2011.

Impact line: Eastern edge of Highway 43.

Accelerometer Line: Running perpendicular to the impact line and Highway 43.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.

Site 9: Vibration Test Location

Site 9: Avenue 112 and Highway 43 (Northeast of canal)

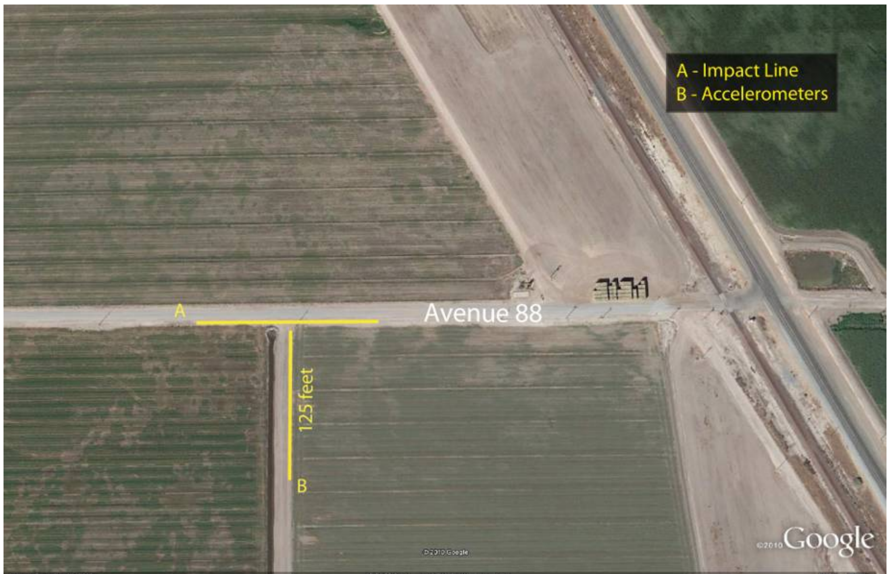
Site 10: Avenue 88

Test Date: 7 January 2011.

Impact line: Southern edge of Avenue 88.

Accelerometer Line: Perpendicular south of the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.



Site 10: Vibration Test Location

Site 10: Avenue 88

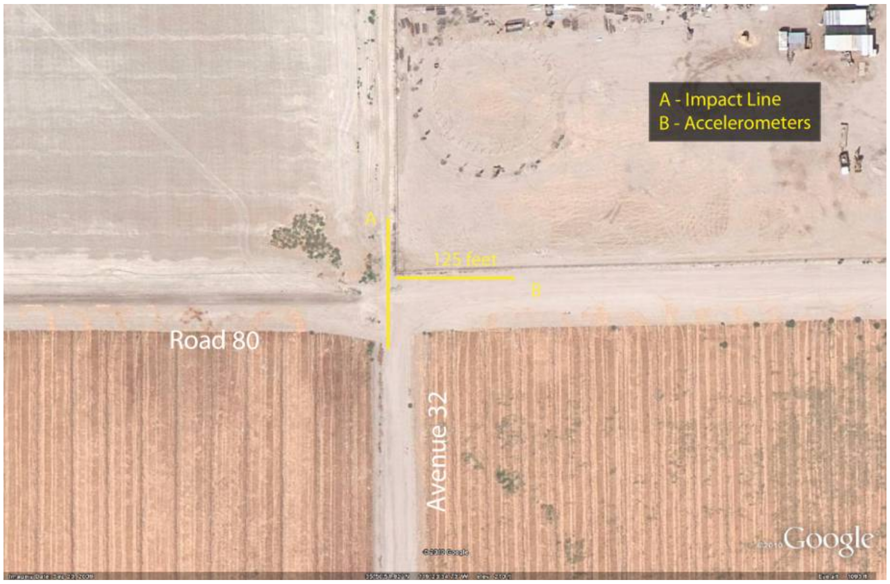
Site 11: Road 80 and Avenue 32

Test Date: 7 January 2011.

Impact line: Southern edge of Road 80.

Accelerometer Line: On the eastern edge of Avenue 32, perpendicular south of the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.



Site 11: Vibration Test Location

Site 11: Road 80 and Avenue 32

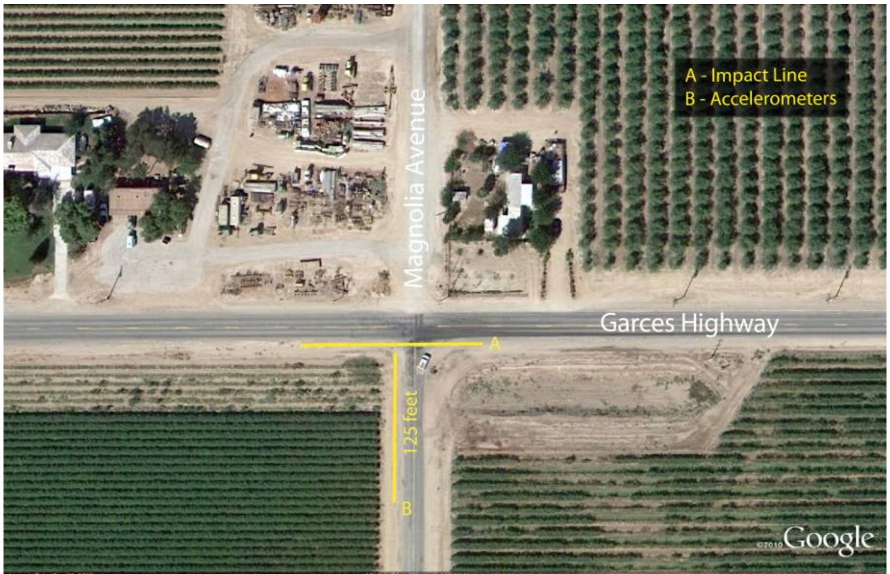
Site 12: Garces Highway and Magnolia Avenue

Test Date: 16 December 2010.

Impact line: Southern edge of Garces Highway.

Accelerometer Line: On the western edge of Magnolia Avenue south of Garces Highway (running perpendicular to the impact line).

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 125 feet.



Site 12: Vibration Test Location

Site 12: Garces Highway and Magnolia Avenue

Site 13: North Palm Avenue and Taussig Avenue

Test Date: 6 January 2011.

Impact line: Western edge of North Palm Avenue.

Accelerometer Line: On the southern edge of Taussig Avenue west of North Palm Avenue (perpendicular to the impact line).

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 150 feet.

Site 13: Vibration Test Location

Site 13: North Palm Avenue and Taussig Avenue

Site 14: Poso Avenue and Root Avenue

Test Date: 6 January 2011.

Impact line: Eastern edge of Root Avenue.

Accelerometer Line: On the northern edge of Poso Avenue east of Root Avenue (perpendicular to the impact line).

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 150 feet.

Site 14: Vibration Test Location

Site 14: Poso Avenue and Root Avenue

Site 15: McCrumb Lane and Venable Lane

Test Date: 7 January 2011.

Impact line: Adjacent to Highway 43 on a plot of undeveloped land bordered by Venable Lane and McCrumb Lane.

Accelerometer Line: Perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 180 feet.

Site 15: Vibration Test Location

Site 15: McCrumb Lane and Venable Lane

Site 16: Lerdo Highway and Cherry Avenue

Test Date: 7 January 2011.

Impact line: Eastern edge of Cherry Avenue.

Accelerometer Line: In the southeast quadrant of the intersection running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 150 feet.

Site 16: Vibration Test Location

Site 16: Lerdo Highway and Cherry Avenue

Site 17: Fenucchi Way and Zachary Avenue

Test Date: 7 January 2011.

Impact line: Eastern edge of Zachary Avenue.

Accelerometer Line: On the northern edge of Fenucchi Way east of Zachary Avenue (running perpendicular to the impact line).

Accelerometer Distances from Impact Line: 25, 50, 75, 100, 150, and 200 feet.

Site 17: Vibration Test Location

Site 17: Fenucchi Way and Zachary Avenue

Site 18: Brimhall Road and Harvest Creek Road

Test Date: 7 January 2011.

Impact line: Northern edge of Brimhall Road.

Accelerometer Line: On the undeveloped lot opposite to Harvest Creek Road, running perpendicular to the impact line.

Accelerometer Distances from Impact Line: 25, 50, 75, 100, and 150 feet.

Site 18: Vibration Test Location

Site 18: Brimhall Road and Harvest Creek Road

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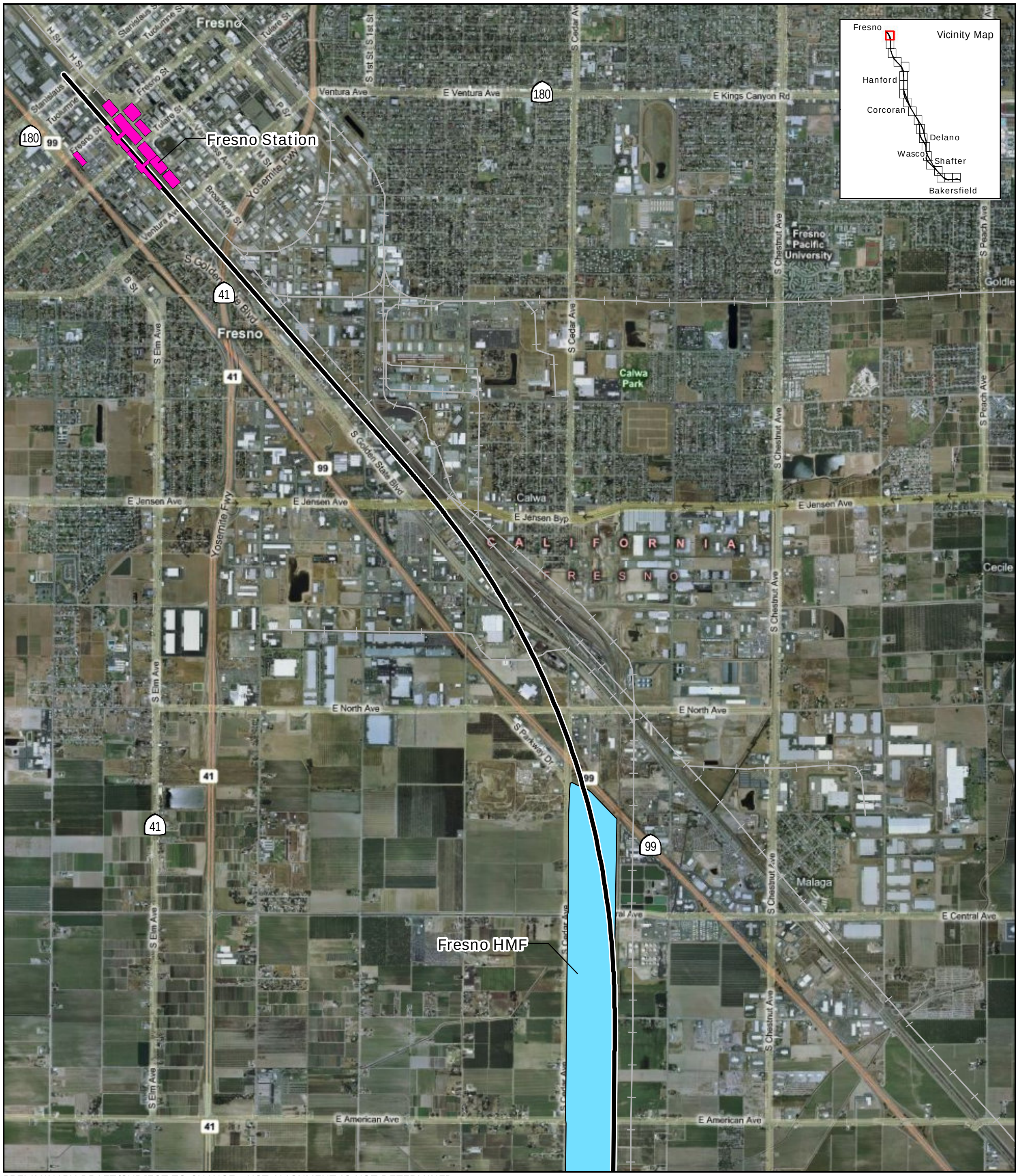
Appendix H
Potential Noise Barrier Sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

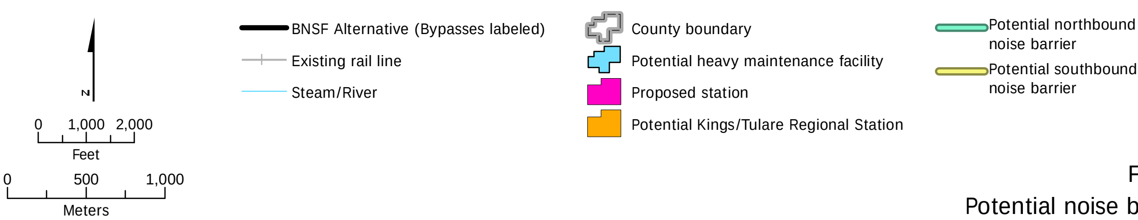
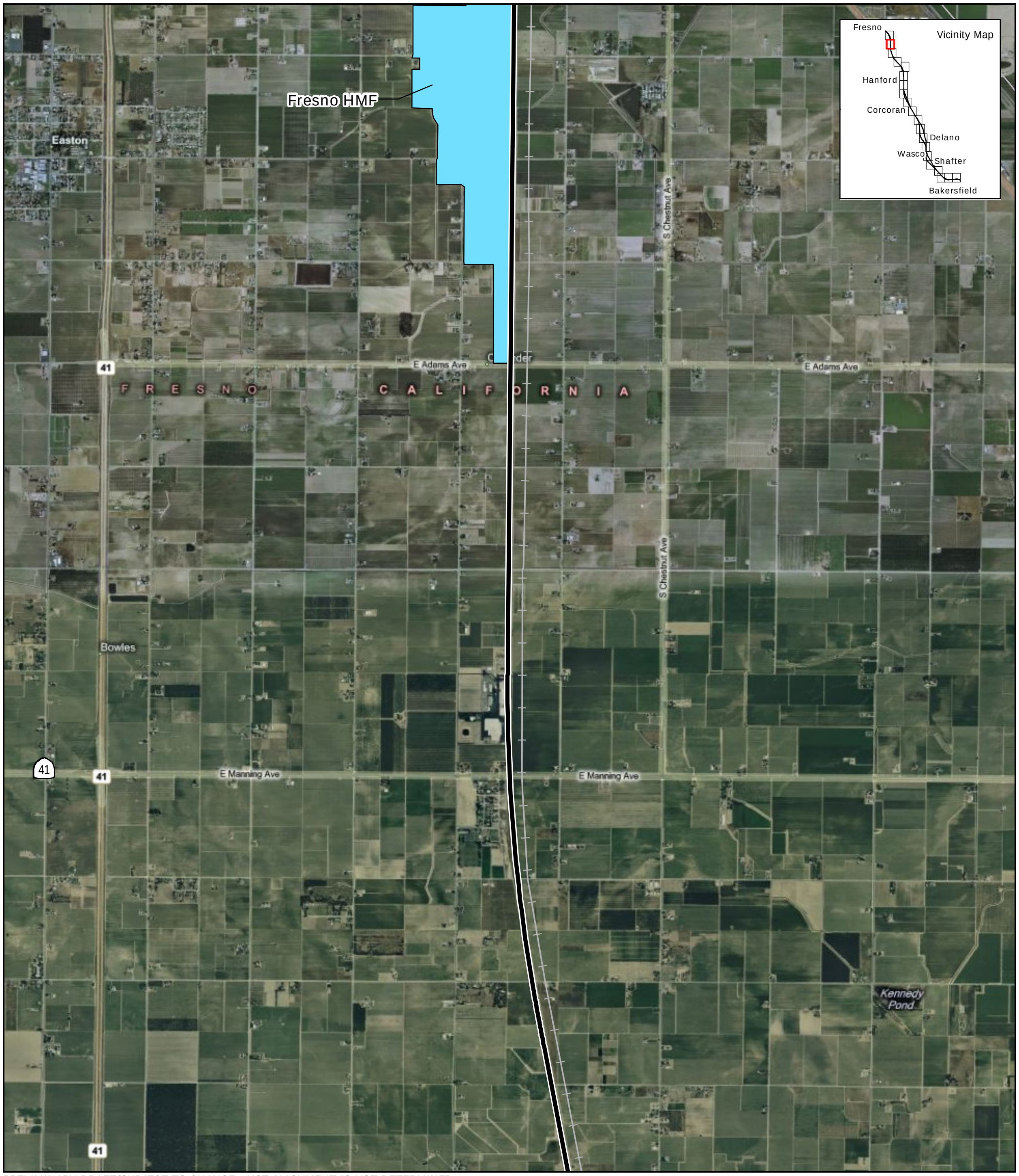


Figure **H**-1
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

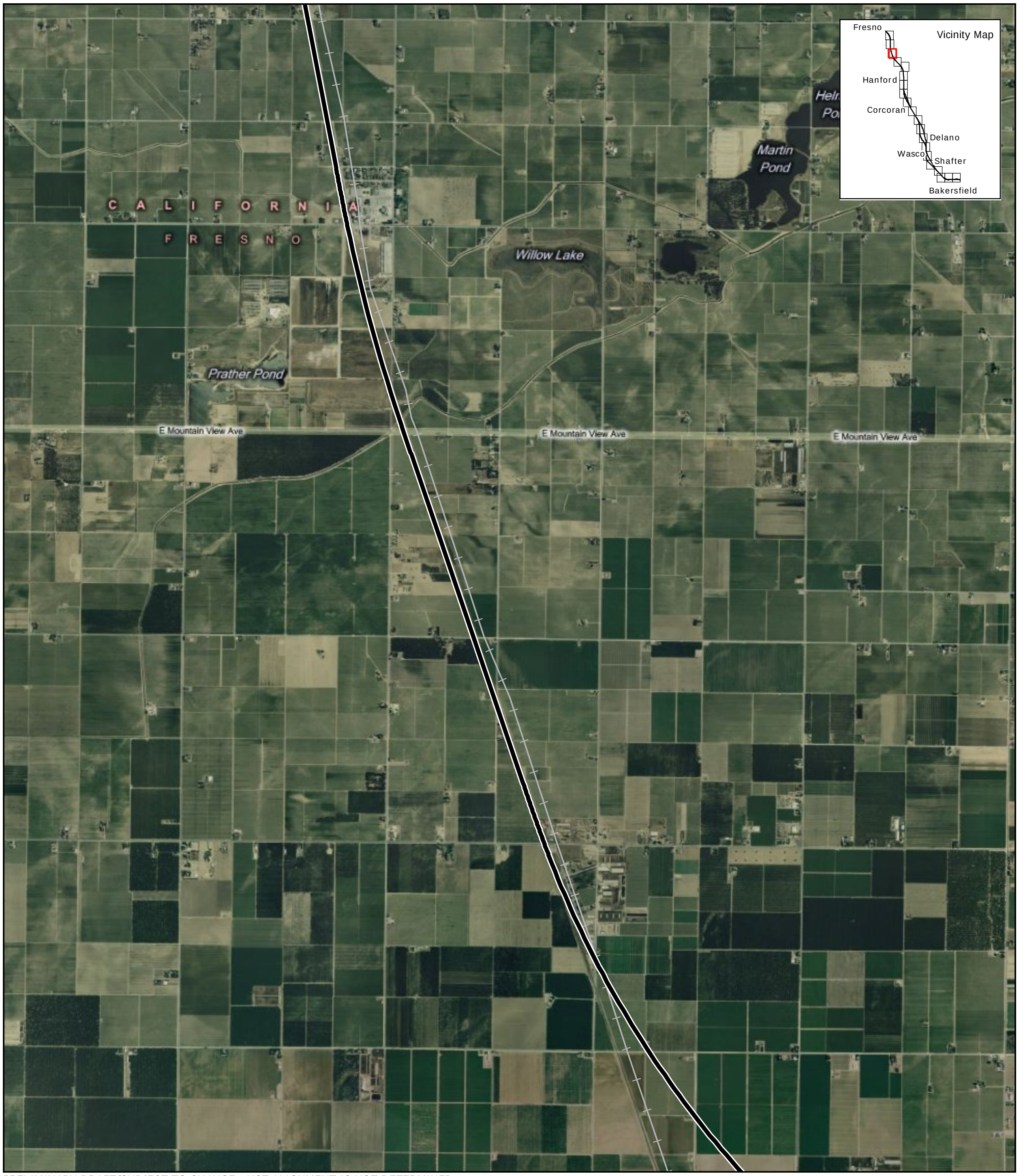
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-2
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

N

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Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-3
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

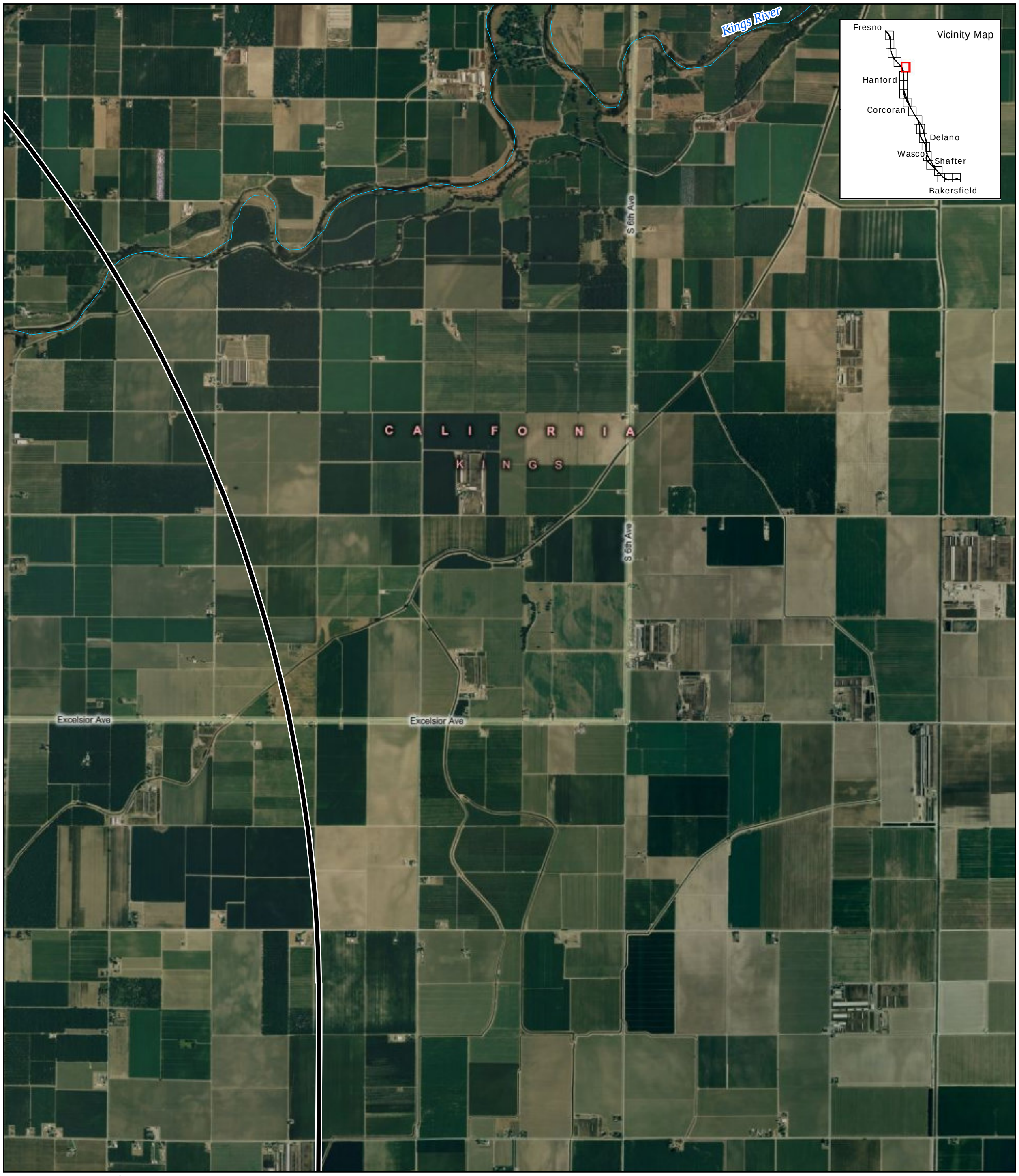
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure H-4
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

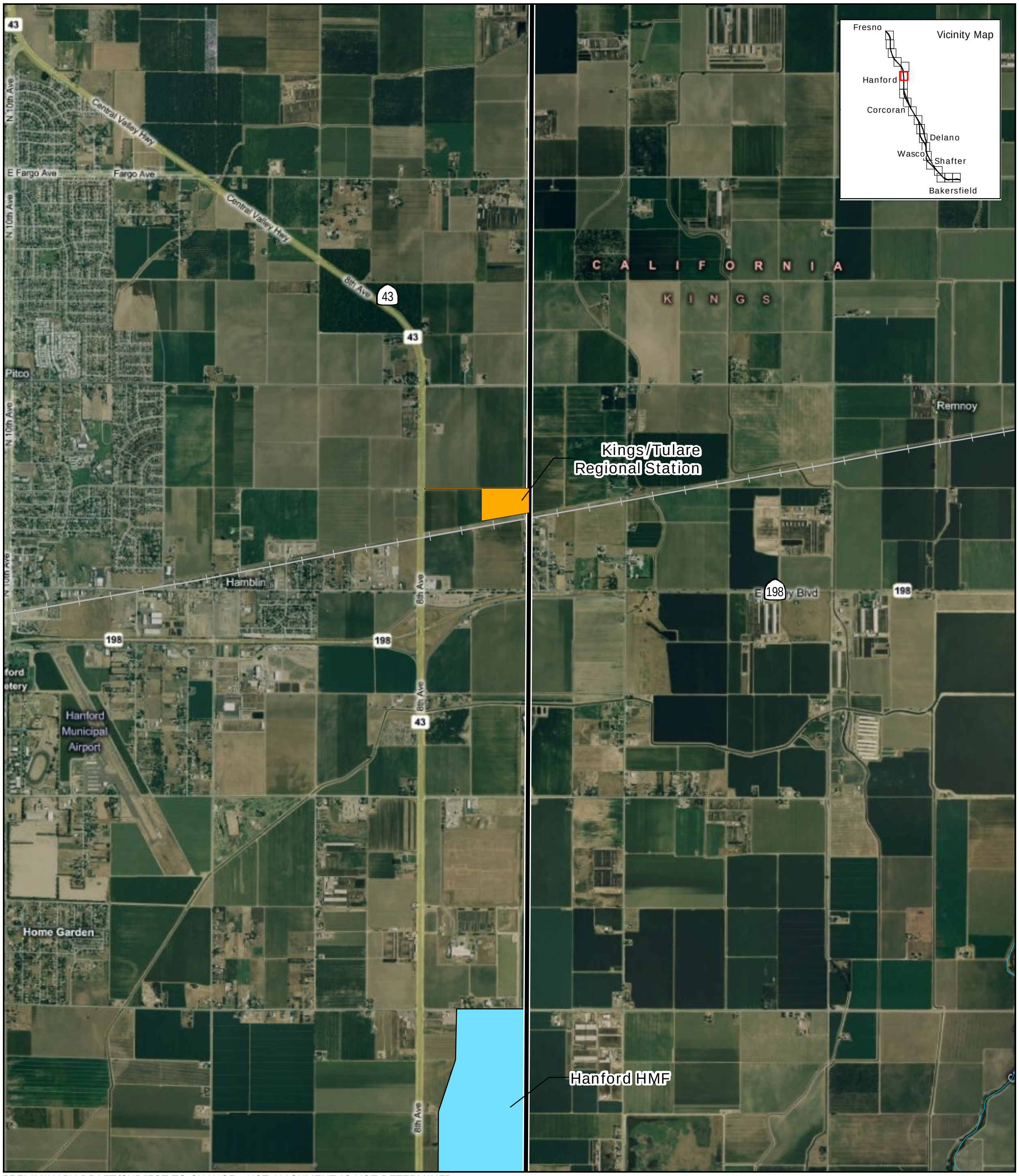
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

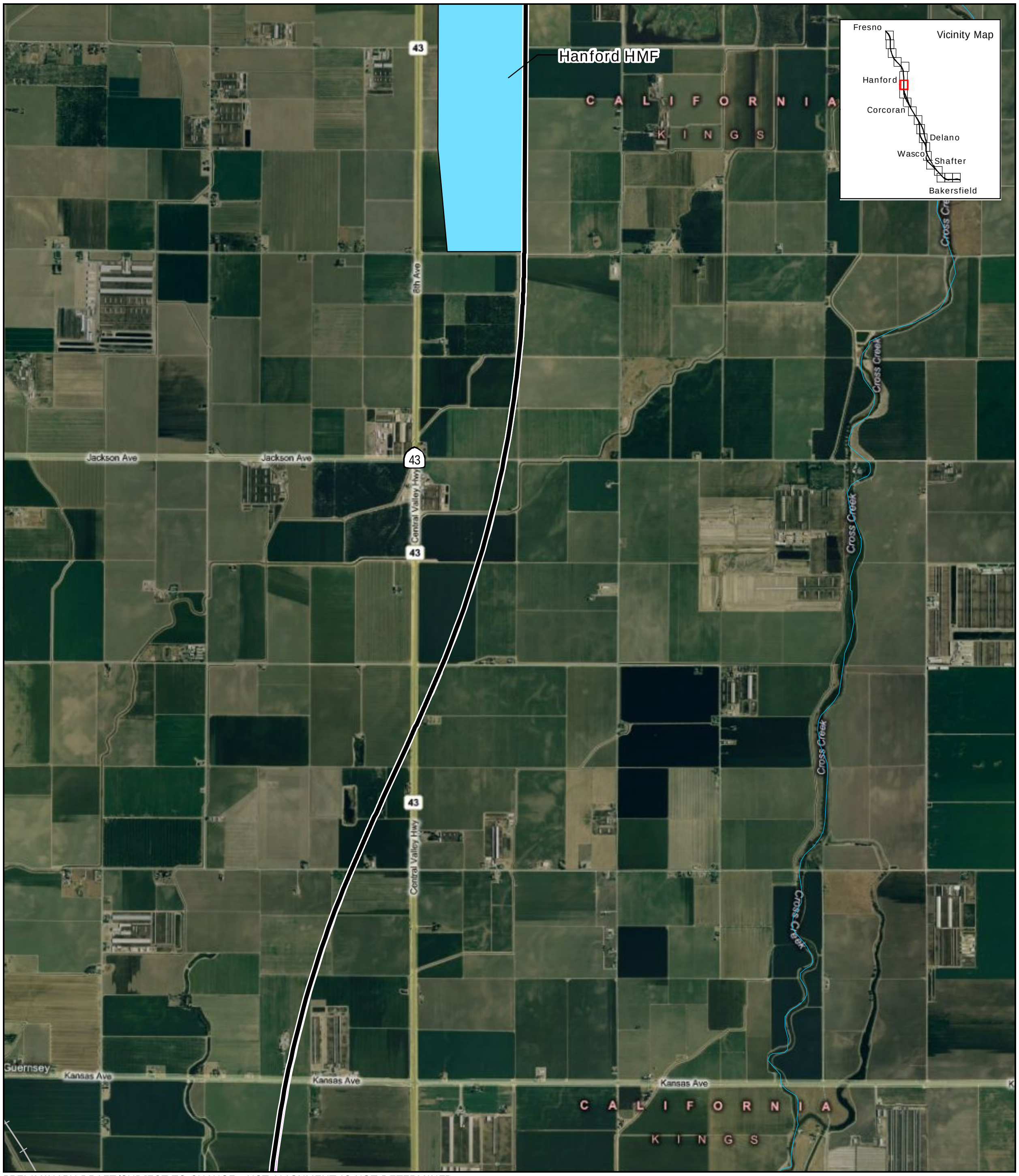
Figure **H**-5
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

Figure **H**-6
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

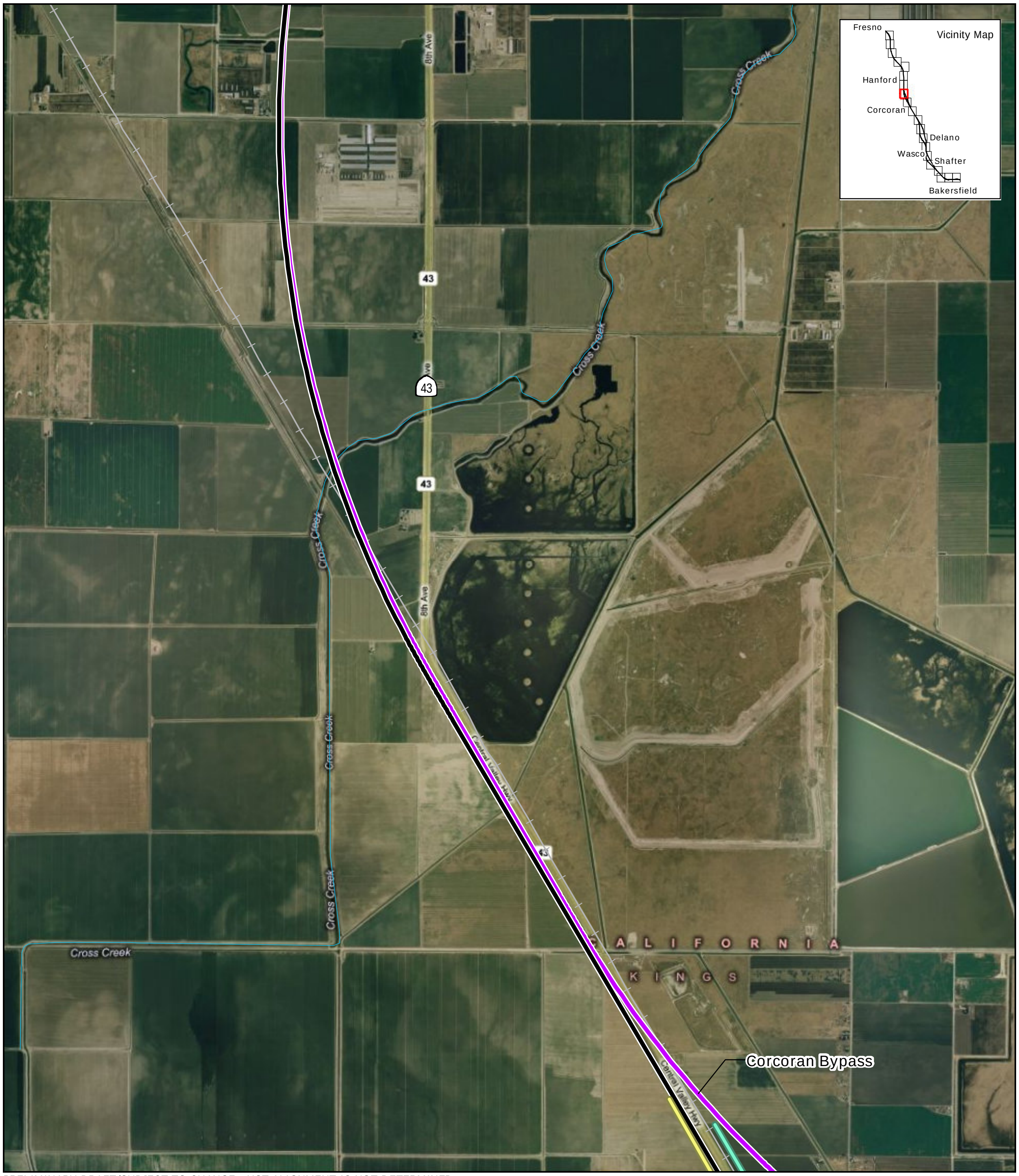
N

0 1,000 2,000 Feet

0 500 1,000 Meters

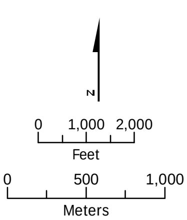
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure H-7
Potential noise barrier sites



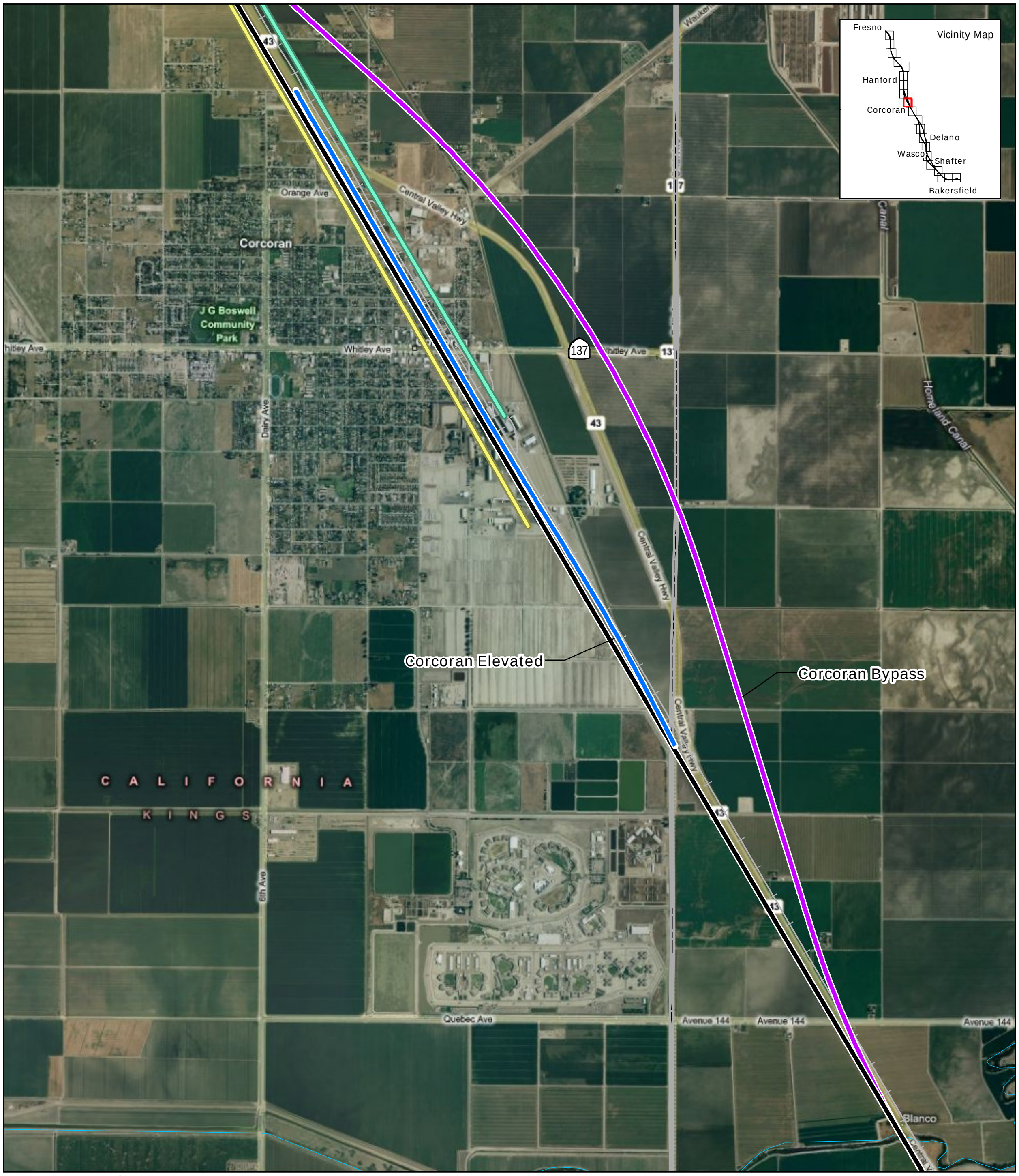
PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011



BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

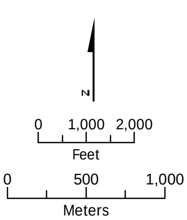
Figure **H**-8
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011



BNSF Alternative (Bypasses labeled)

Existing rail line

Steam/River

County boundary

Potential heavy maintenance facility

Proposed station

Potential Kings/Tulare Regional Station

Potential northbound noise barrier

Potential southbound noise barrier

Figure H-9
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

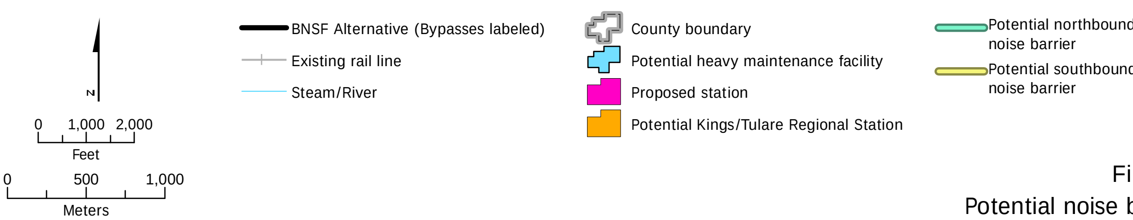


Figure **H**-10
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

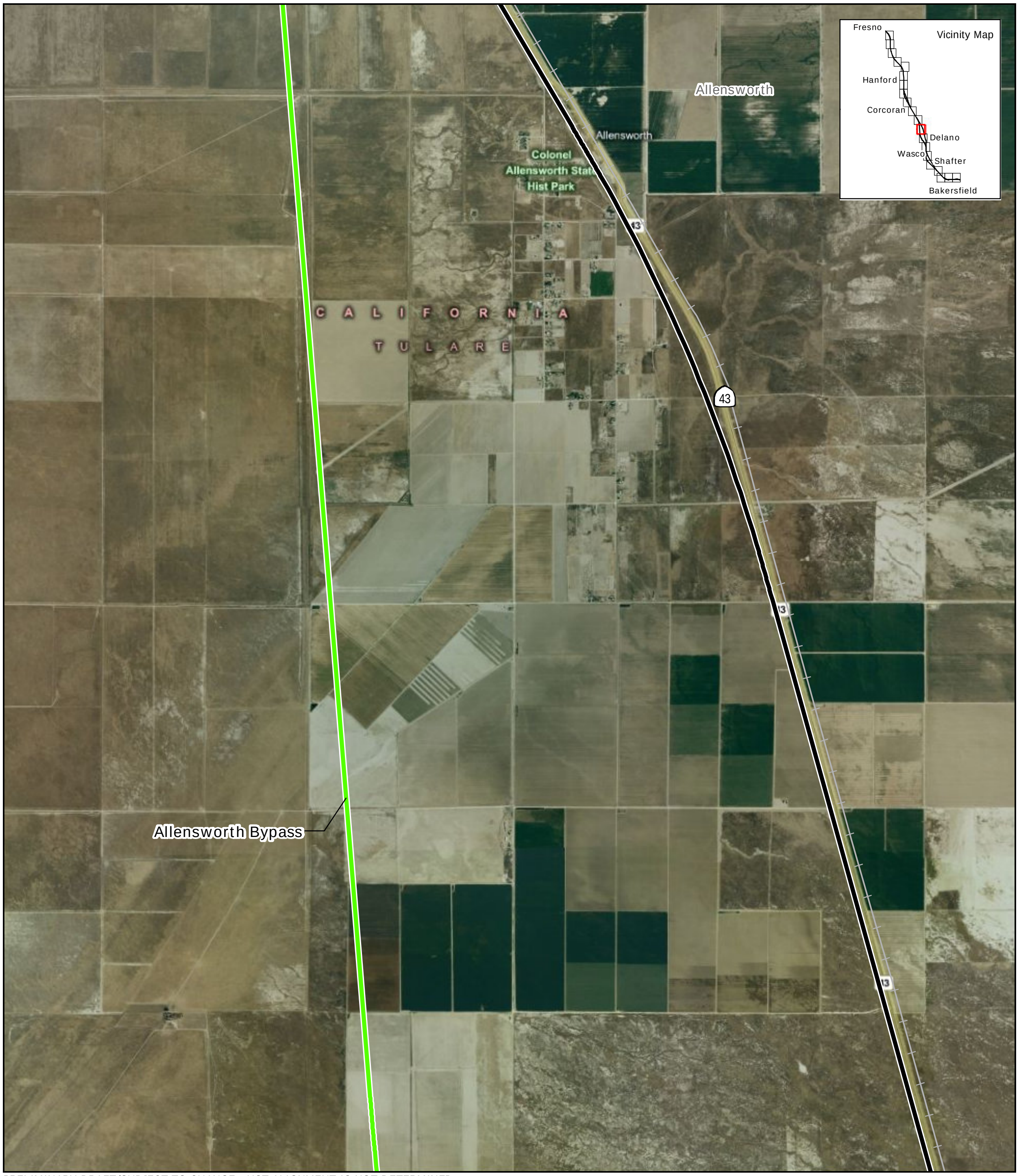
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-11
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-12
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: URS, 2011

June 2, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-13
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

Data source: URS, 2011

June 2, 2011

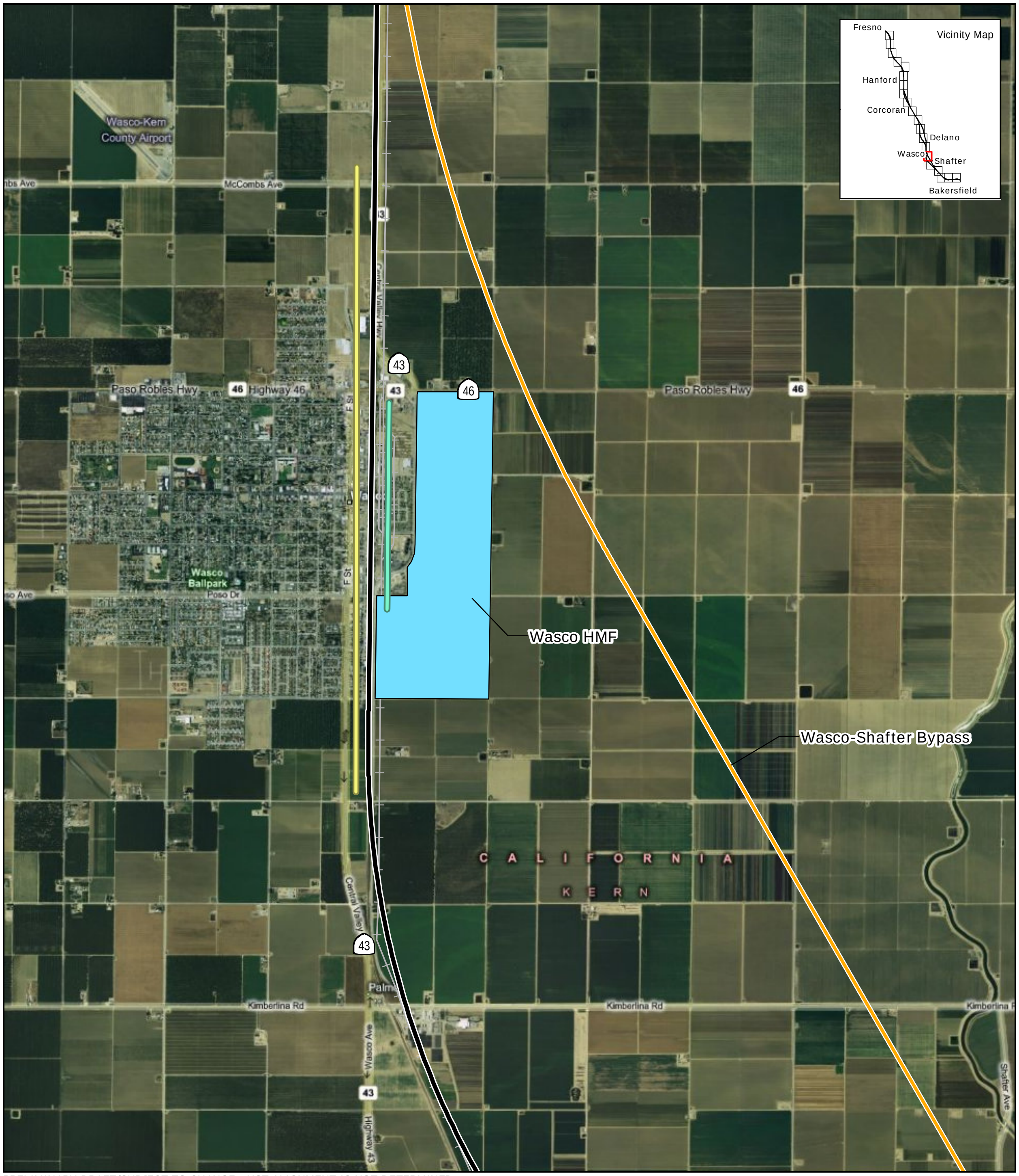
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Potential northbound noise barrier
- Potential southbound noise barrier

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **H**-14
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

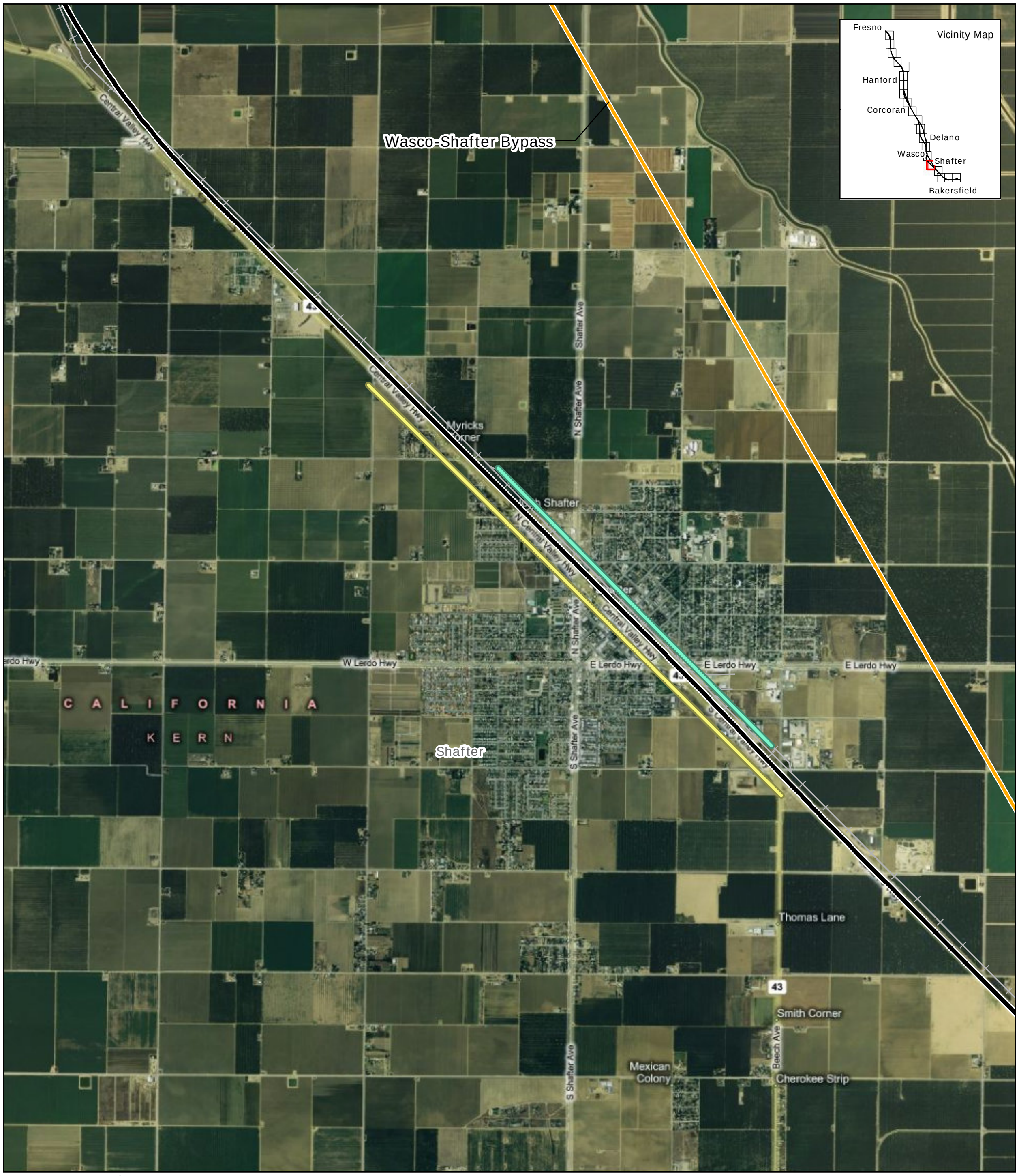
BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

N

0 1,000 2,000
Feet

0 500 1,000
Meters

Figure **H**-15
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011

N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-16
Potential noise barrier sites

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

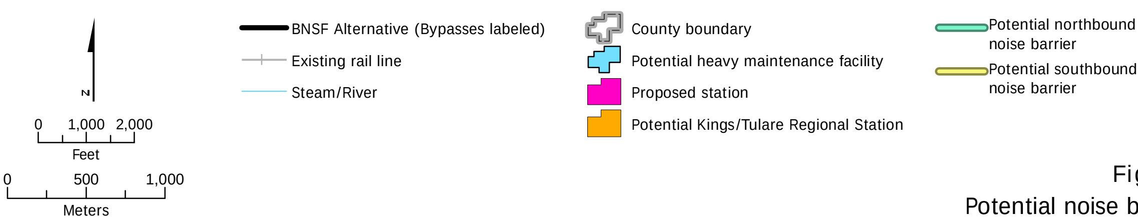
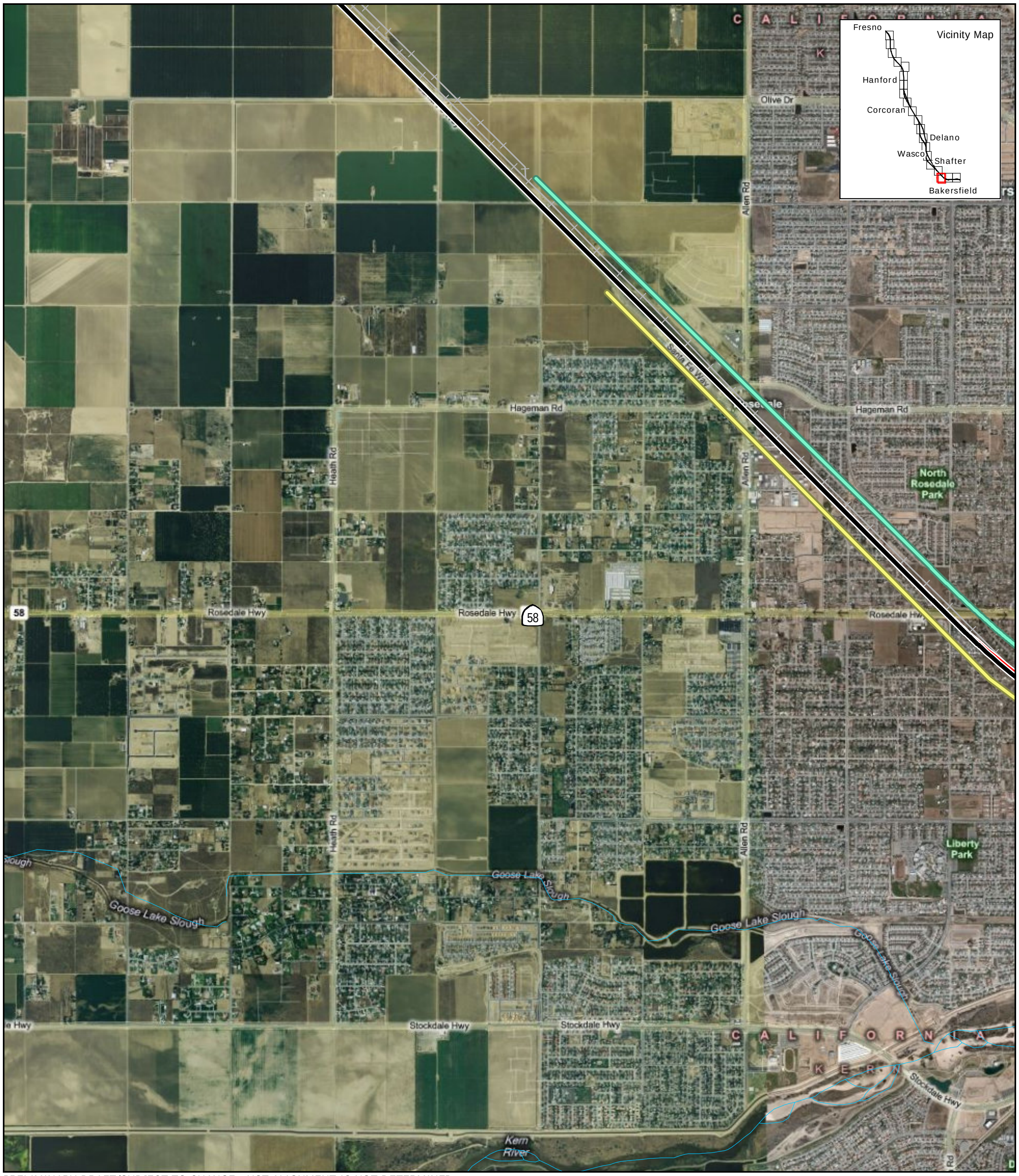


Figure **H**-17

Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

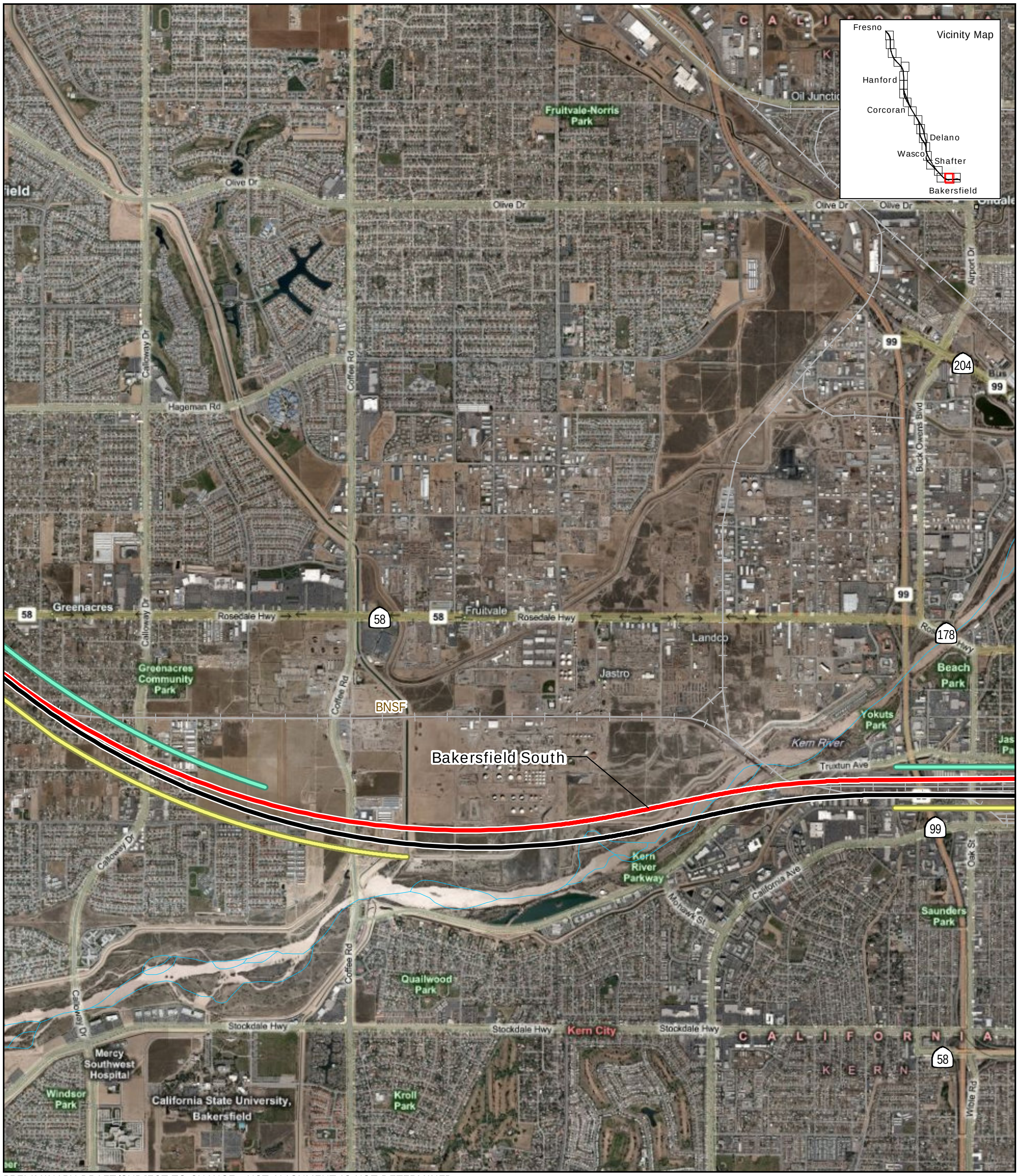
- BNSF Alternative (Bypasses labeled)
- Existing rail line
- Steam/River
- County boundary
- Potential heavy maintenance facility
- Proposed station
- Potential Kings/Tulare Regional Station
- Potential northbound noise barrier
- Potential southbound noise barrier

N

0 1,000 2,000 Feet

0 500 1,000 Meters

Figure **H**-18
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
June 2, 2011
Data source: URS, 2011

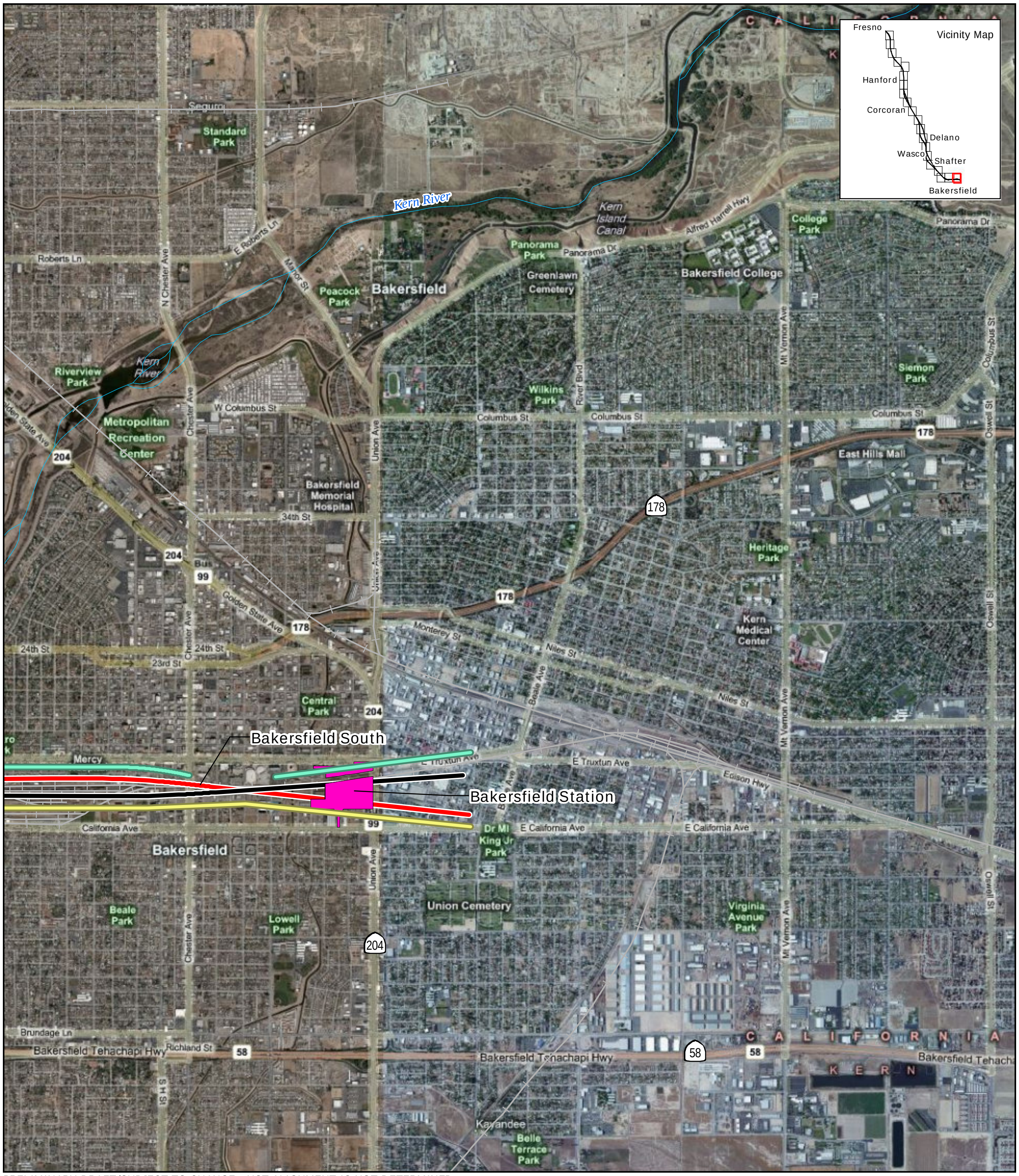
N

0 1,000 2,000
Feet

0 500 1,000
Meters

BNSF Alternative (Bypasses labeled)
Existing rail line
Steam/River
County boundary
Potential heavy maintenance facility
Proposed station
Potential Kings/Tulare Regional Station
Potential northbound noise barrier
Potential southbound noise barrier

Figure **H**-19
Potential noise barrier sites



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

June 2, 2011

Data source: URS, 2011

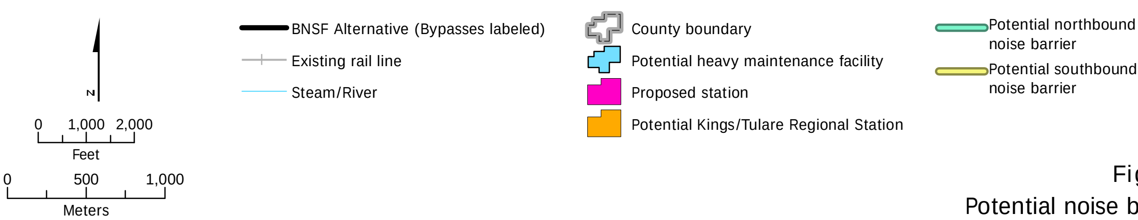


Figure **H**-20
Potential noise barrier sites

Appendix I

High-Speed Train Corridor Construction Equipment List by Construction Phase

Equipment	Horse-power	Quantity (each / site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Mobilization (January 2013–October 2013)						
Flatbed truck – 1 ton	175	15	3	45	195	87,750
Flatbed truck – 5 ton	210	15	3	45	195	87,750
Flatbed tractor/trailer	300–500	30	3	90	195	175,500
Service truck – fuel/lube	300	5	3	15	195	29,250
Water truck	210	5	3	15	195	29,250
Light plant – 4 lights	10	10	3	30	195	58,500
Truck dump 18-CY triaxle	200	5	3	15	195	29,250
Boom truck – 20 ton	330	5	3	15	195	29,250
Cat 416E backhoe	87	2	3	6	195	11,700
Cat 330 2.5-CY excavator	300	1	3	3	195	5,850
Cat D6K dozer	125	2	3	6	195	11,700
Site Prep (April 2013–August 2013)						
Cat 416E backhoe	87	5	3	15	90	13,500
Cat 426 backhoe	97	5	3	15	90	13,500
Cat D6K dozer	125	5	3	15	90	13,500
Cat D8N dozer	310	5	3	15	90	13,500
Cat D9N dozer	410	5	3	15	90	13,500
Cat D11N dozer	850	5	3	15	90	13,500
Cat 330 2.5-CY excavator	300	5	3	15	90	13,500
Cat 375 excavator (36)	450	5	3	15	90	13,500
Cat 930H wheel loader – 2.6 CY	149	5	3	15	90	13,500
Cat 950H wheel loader – 4 CY	197	5	3	15	90	13,500
Cat 966H wheel loader – 5.5 CY	262	5	3	15	90	13,500
Cat 980H wheel loader – 7.5 CY	349	5	3	15	90	13,500
Scissor lift – 19 foot	15	1	3	3	90	2,700
Scissor lift – 32 foot	28	1	3	3	90	2,700
Electric sump pump – 4 inch	2	5	3	15	90	13,500
Electric sump pump – 8 inch	4	5	3	15	90	13,500
Flatbed truck – 1 ton	175	15	3	45	90	40,500
Flatbed truck – 5 ton	210	15	3	45	90	40,500
Water truck	210	15	3	45	90	40,500
Service truck – fuel/lube	300	2	3	6	90	5,400
Cat 631E scraper – 31 CY	335	2	3	6	91	5,460
Earth Moving (August 2013–August 2015)						
Roadway saw (w/blades)	120	5	3	15	522	78,300
Cat 416E backhoe	87	5	3	15	522	78,300
Cat 426 backhoe	97	5	3	15	522	78,300
Cat D6K dozer	125	5	3	15	522	78,300
Cat D8N dozer	310	5	3	15	522	78,300
Cat D9N dozer	410	5	3	15	522	78,300

Equipment	Horse-power	Quantity (each / site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Cat D11N dozer	850	2	3	6	522	31,320
Cat 330 2.5-CY excavator	300	4	3	12	522	62,640
Cat 375 excavator (36)	450	4	3	12	522	62,640
Chain trencher	40	2	3	6	522	31,320
Cat 930H wheel loader – 2.6 CY	149	5	3	15	522	78,300
Cat 950H wheel loader – 4 CY	197	5	3	15	522	78,300
Cat 966H wheel loader – 5.5 CY	262	5	3	15	522	78,300
Cat 980H wheel loader – 7.5 CY	349	5	3	15	522	78,300
Cat 120H motorgrader	158	5	3	15	522	78,300
Cat 14G motorgrader	260	5	3	15	522	78,300
Pad foot roller	83	5	3	15	522	78,300
Pneumatic roller	156	5	3	15	522	78,300
Steel wheel roller	174	5	3	15	522	78,300
Walk-behind whacker	15	5	3	15	522	78,300
Cat 627 scraper (20)	266	10	3	30	522	156,600
Cat 631E scraper – 31 CY	335	10	3	30	522	156,600
Cat 633D scraper – 34 CY	400	10	3	30	522	156,600
Flatbed truck – 1 ton	175	10	3	30	522	156,600
Flatbed truck – 5 ton	210	10	3	30	522	156,600
Cat 735 articu truck (16 CY)	385	2	3	6	522	31,320
Truck dump – 18-CY triaxle	200	10	3	30	522	156,600
Distributor truck	150	10	3	30	522	156,600
Service truck – fuel/lube	300	10	3	30	522	156,600
Water truck	210	10	3	30	522	156,600
Light plant – 4 lights	10	40	3	120	522	626,400
Construct Road Crossings (October 2013–April 2017)						
Air compressor – 185 CFM	50	10	3	30	900	270,000
Air compressor – 900 CFM	450	10	3	30	900	270,000
Asphalt paver (LG)	180	5	3	15	900	135,000
Aggregate spreader	60	5	3	15	900	135,000
Sweeper	25	5	3	15	900	135,000
Shuttle buggy	20	5	3	15	900	135,000
Roadway saw (w/blades)	120	2	3	6	900	54,000
Auger, truck mounted, large	250	3	3	9	900	81,000
Auger, truck mounted, small	200	3	3	9	900	81,000
Cat 416E backhoe	87	5	3	15	900	135,000
Cat 426 backhoe	97	5	3	15	900	135,000
Concrete paver – 12/15 foot	30	5	3	15	900	135,000
Concrete conveyer – 100' foot		5	3	15	900	135,000
Gas engine vibrator	15	5	3	15	900	135,000
Concrete saw	13	5	3	15	900	135,000

Equipment	Horse-power	Quantity (each / site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Concrete pump – 50 CY/hr	100	5	3	15	900	135,000
Crane, 50 T , crawler	420	5	3	15	900	135,000
Boom truck – 20 ton	330	5	3	15	900	135,000
Crawler crane – 250 ton	420	2	3	6	900	54,000
Crawler crane – 300 ton	470	2	3	6	900	54,000
Carrydeck crane – 8 ton	140	2	3	6	900	54,000
Crane flatbed mount – 3 ton	75	2	3	6	900	54,000
Cat D6K dozer	125	1	3	3	900	27,000
Cat D8N dozer	310	1	3	3	900	27,000
Cat D9N dozer	410	1	3	3	900	27,000
Cat D11N dozer	850	1	3	3	900	27,000
Cat 330 2.5-CY excavator	300	5	3	15	900	135,000
Cat 375 excavator (36)	450	1	3	3	900	27,000
Cat 930H wheel loader – 2.6 CY	149	2	3	6	900	54,000
Cat 950H wheel loader – 4 CY	197	2	3	6	900	54,000
Cat 966H wheel loader – 5.5 CY	262	2	3	6	900	54,000
Cat 980H wheel loader – 7.5 CY	349	2	3	6	900	54,000
Scissor lift – 19 foot	15	2	3	6	900	54,000
Scissor lift – 32 foot	28	2	3	6	900	54,000
Cat 120H motorgrader	158	2	3	6	900	54,000
Cat 14G motorgrader	260	2	3	6	900	54,000
Off-highway trucks (725)	309	3	3	9	900	81,000
Off-highway trucks (740)	469	3	3	9	900	81,000
Delmag D36 – 32 (diesel)	92	2	3	6	900	54,000
Delmag D80 (diesel)	245	2	3	6	900	54,000
Delmag D100 – 13 (diesel)	335	2	3	6	900	54,000
Electric sump pump – 4 inch	2	5	3	15	900	135,000
Electric sump pump – 8 inch	4	5	3	15	900	135,000
Pad foot roller	83	5	3	15	900	135,000
Pneumatic roller	156	5	3	15	900	135,000
Steel-wheel roller	174	5	3	15	900	135,000
Walk-behind whacker	15	5	3	15	900	135,000
Flatbed truck – 1 ton	175	5	3	15	900	135,000
Flatbed truck – 5 ton	210	2	3	6	900	54,000
Cat 735 articu truck – 16 CY	385	2	3	6	900	54,000
Ready-mix truck	200	20	3	60	900	540,000
Truck dump – 18-CY triaxle	200	20	3	60	900	540,000
Distributor truck	150	10	3	30	900	270,000
Service truck – fuel/lube	300	5	3	15	900	135,000
Water truck	210	10	3	30	900	270,000
Welding machine		10	3	30	900	270,000

Equipment	Horse-power	Quantity (each/ site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Butt fusion machine, electric	30	10	3	30	900	270,000
Genset – 15 kW	20	10	3	30	900	270,000
Genset – 100 kW	134	5	3	15	900	135,000
Light plant – 4 lights	10	25	3	75	900	675,000
Concrete batch plant		1	3	3	900	27,000
Flatbed tractor/trailer	500	5	3	15	900	135,000
Construct Elevated Structures (August 2013–June 2017)						
Air compressor – 185 CFM	50	10	3	30	1,000	300,000
Air compressor – 900 CFM	450	10	3	30	1,000	300,000
Asphalt paver (LG)	180	10	3	30	1,000	300,000
Aggregate spreader	60	5	3	15	1,000	150,000
Sweeper	25	5	3	15	1,000	150,000
Shuttle buggy	20	5	3	15	1,000	150,000
Roadway saw (w/blades)	120	5	3	15	1,000	150,000
Auger, truck-mounted, large	250	5	3	15	1,000	150,000
Auger, truck-mounted, small	200	5	3	15	1,000	150,000
Cat 416E backhoe	87	5	3	15	1,000	150,000
Cat 426 backhoe	97	5	3	15	1,000	150,000
Concrete paver – 12/15 foot	30	5	3	15	1,000	150,000
Concrete conveyer (100 foot)		5	3	15	1,000	150,000
Gas engine vibrator	15	10	3	30	1,000	300,000
Concrete saw	13	10	3	30	1,000	300,000
Concrete pump – 50 CY/hr	100	10	3	30	1,000	300,000
Crane, 50 T, crawler	420	5	3	15	1,000	150,000
Boom truck – 20 ton	330	10	3	30	1,000	300,000
Crawler crane – 250 ton	420	2	3	6	1,000	60,000
Crawler crane – 300 ton	470	2	3	6	1,000	60,000
Carrydeck crane – 8 ton	140	2	3	6	1,000	60,000
Crane flatbed mount – 3 ton	75	2	3	6	1,000	60,000
Cat D6K dozer	125	3	3	9	1,000	90,000
Cat D8N dozer	310	3	3	9	1,000	90,000
Cat D9N dozer	410	3	3	9	1,000	90,000
Cat D11N dozer	850	2	3	6	1,000	60,000
Cat 330 2.5-CY excavator	300	10	3	30	1,000	300,000
Cat 375 excavator (36)	450	2	3	6	1,000	60,000
Chain trencher	40	5	3	15	1,000	150,000
Cat 930H wheel loader – 2.6 CY	149	5	3	15	1,000	150,000
Cat 950H wheel loader – 4 CY	197	5	3	15	1,000	150,000
Cat 966H wheel loader – 5.5 CY	262	5	3	15	1,000	150,000
Cat 980H wheel loader – 7.5 CY	349	5	3	15	1,000	150,000
Scissor lift – 19 foot	15	10	3	30	1,000	300,000

Equipment	Horse-power	Quantity (each / site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Scissor lift – 32 foot	28	10	3	30	1,000	300,000
Cat 120H motorgrader	158	2	3	6	1,000	60,000
Cat 14G motorgrader	260	2	3	6	1,000	60,000
Off-highway trucks (725)	309	3	3	9	1,000	90,000
Off-highway trucks (740)	469	3	3	9	1,000	90,000
Delmag D36 – 32 (diesel)	92	2	3	6	1,000	60,000
Delmag D80 (diesel)	245	2	3	6	1,000	60,000
Delmag D100 – 13 (diesel)	335	2	3	6	1,000	60,000
Electric sump pump – 4 inch	2	10	3	30	1,000	300,000
Electric sump pump – 8 inch	4	10	3	30	1,000	300,000
Pad foot roller	83	5	3	15	1,000	150,000
Pneumatic roller	156	5	3	15	1,000	150,000
Steel wheel roller	174	5	3	15	1,000	150,000
Walk-behind whacker	15	5	3	15	1,000	150,000
Flatbed truck – 1 ton	175	10	3	30	1,000	300,000
Flatbed truck – 5 ton	210	10	3	30	1,000	300,000
Cat 735 articu truck – 16 CY	385	2	3	6	1,000	60,000
Ready-mix truck	200	20	3	60	1,000	600,000
Truck dump – 18-CY triaxle	200	20	3	60	1,000	600,000
Distributor truck	150	10	3	30	1,000	300,000
Service truck – fuel/lube	300	5	3	15	1,000	150,000
Water truck	210	10	3	30	1,000	300,000
Welding machine		10	3	30	1,000	300,000
Butt fusion machine, electric	30	10	3	30	1,000	300,000
Genset – 15 kW	20	10	3	30	1,000	300,000
Genset – 100 kW	134	5	3	15	1,000	150,000
Light plant – 4 lights	10	25	3	75	1,000	750,000
Concrete batch plant		1	3	3	1,000	30,000
Flatbed tractor/trailer	500	5	3	15	1,000	150,000
Precast plant		1	3	3	1,000	30,000
Lay Track (August 2015–April 2018)						
Ballast compactors	185	5	3	15	700	105,000
Ballast cribbers	250	5	3	15	700	105,000
Ballast regulators	232	5	3	15	700	105,000
Car movers	250	5	3	15	700	105,000
Continuous action tampers	466	5	3	15	700	105,000
Manually propelled adzes	6	5	3	15	700	105,000
Motor cars	125	2	3	6	700	42,000
Motorized carts	25	2	3	6	700	42,000
On-track tie handlers	99	5	3	15	700	105,000
Portable rail drills	3	20	3	60	700	420,000

Equipment	Horse-power	Quantity (each/ site)	No. of Sites	Total Pieces	Approximate Activity Duration (days)	Total Equipment Hours
Portable rail grinders	3	20	3	60	700	420,000
Portable rail saws	5	20	3	60	700	420,000
Production/switch tampers	232	5	3	15	700	105,000
Rail lifters	23	10	3	30	700	210,000
Self-propelled adzers	42	6	3	18	700	126,000
Self-propelled rail saws	88	6	3	18	700	126,000
Spot/utility tampers	83	6	3	18	700	126,000
Tie removers/inserters	185	10	3	30	700	210,000
Track undercutters	950	6	3	18	700	126,000
Walk-behind drivers/setters	34	6	3	18	700	126,000
Walk-behind pullers	9	6	3	18	700	126,000
Demob (April 2018–August 2018)						
Flatbed truck – 1 ton	175	15	3	45	90	40,500
Flatbed truck – 5 ton	210	15	3	45	90	40,500
Flatbed tractor/trailer	300-500	30	3	90	90	81,000
Service truck – fuel/lube	300	5	3	15	90	13,500
Water truck	210	5	3	15	90	13,500
Light plant – 4 lights	10	10	3	30	90	27,000
Truck dump – 18-CY triaxle	200	5	3	15	90	13,500
Boom truck – 20 ton	330	5	3	15	90	13,500
Cat 416E backhoe	87	2	3	6	90	5,400
Cat 330 2.5-CY excavator	300	1	3	3	90	2,700
Cat D6K dozer	125	2	3	6	90	5,400

Acronyms and Abbreviations:

Cat = Caterpillar Incorporated
CFM = cubic feet per minute
CY = cubic yards
CY/hr = cubic yards per hour
kW = kilowatts

LG = large